THE AMERICAN GAS LIGHT JOURNAL

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXXVIII., No. 10. Whole No. 1,709. | NEW YORK, MONDAY, MARCH 9, 1908. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. THOMAS J. CUNNINGHAM, ELBERT P. CALLENDER, } Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, New York.

Telephone.—2996 John.

Terms of Subscription, Including Postage.—For the United States, $3; Canada, $4 per annum. European countries, $5 (£1—25 francs).

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A.M. Callender & Co.

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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Fourth Annual Meeting, Illinois Gas Association.

OFFICE OF THE SECRETARY,
EAST ST. LOUIS, ILLS., Feb. 26, 1908.

To the Members of the Illinois Gas Association:

The fourth annual meeting of the Illinois Gas Association will be held in Chicago, Wednesday and Thursday, March 25th and 26th.

The Auditorium Hotel has been selected as Association headquarters for this meeting.

The President, Mr. J. H. Eustace, of Chicago, will call the meeting to order at 9:30 A.M., March 25th, in the meeting room at the Auditorium Hotel.

Arrangements have been made for the following papers to be presented:

"New Business Methods," by Mr. C. H. Sidenglanz, Rockford, Ills.
"Retort House Practice," by Mr. W. E. Hartman, Aurora, Ills.
"Office Methods," by Mr. W. J. Achelpohl, Ottawa, Ills.
"Meter Repair Shop Practice," by Mr. C. L. Day, Chicago, Ills.
"The Point of View in Advertising Gas," by Mr. W. D. McJunkin.

Mr. H. L. Rice, Aurora, Ills., has been appointed Chairman of the Committee on Arrangements, and, although plans have not been entirely perfected, members can feel sure that ample provision will be made for their entertainment. The Auditorium Hotel announces the following rates for this meeting:

Single room, without bath.....	$2	and upwards.
Double room, "	3	"
Single room, with bath.....	3	"
Double room, "	5	"

The many hotels in the vicinity of headquarters assure the members of good accommodation. As the best accommodations are secured by having reservations made in advance, it is advised that the members reserve their quarters as far in advance as possible.

Any suggestions in regard to the meeting, or questions which the members would like to have discussed, the Secretary would be pleased to receive at the earliest possible moment. The Secretary will gladly forward application blanks on request. C. H. QUACKENBUSH, Secy.

BRIEFLY TOLD.

RESPECTING PROGRESS IN THE INSTANCE OF UNIFORMITY OF ACCOUNTING BY LIGHTING COMPANIES.—We understand that a tentative classification for the accounts of gas and electric light companies has been prepared by the Public Service Commission for New York city, the schedules having been partly arranged subsequent to conferences between Messrs. Carter and Edwards, respectively Chairman of the Committee on Unifom Accounting of the American Gas Institute and of the National Electric Light Association. We have heard it further intimated that a conference will be held during the latter part of this month by representatives of several commissions and committees interested in this very important undertaking. The latest treatment of this subject, in so far as submitted statements go, was in the report on "Uniform Accounting and Depreciation," handed in by the Committee thereon, of the New England Association of Gas Engineers, at its meeting in Boston last month. We regret that, in the usual order

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of publishing the proceedings of that meeting, the chapters concerning this subject may be somewhat delayed; but it is not likely the executives of the Association will interpose any objection to honoring a request that the report and the discussion thereof may be brought to the notice of the gentlemen who will share in the conference which we understand is shortly to be held. As noted in a previous issue, the Committee of the New England Association in the premises was continued. Further, on motion of Mr. Walter R. Addicks, the Committee was requested to operate in conjunction with the corresponding Committee of the American Gas Institute.

TWO ADDITIONAL QUESTIONS SUBMITTED TO THE BUREAU OF INFORMATION.—We have received from Mr. W. A. Baehr, Chairman of the Bureau of Information, American Gas Institute, two questions (Nos. 12 and 13) for answering. The plan for the replies is as stated in the JOURNAL, dated February 17, the replies going, of course, to Editor Baehr, at his offices, No. 716 Locust street, St. Louis, Mo. The questions are:

No. 12. "What effect has temperature on the revivification of purifying material: First, as to the rate of revivification; second, and as to the minimum temperature at which the reaction will take place?"

Or put in another form: "What is the law of chemical reaction as regards temperature in the revivification of purifying material?"

No. 13. "What is the percentage of variation per minute in the amount of air that we put through the generator per blast, taking the first minute of the run, with carburetter blast valve closed, as 100 per cent.?"

CURRENT COMMENT.—

IN reporting the names of the officers elected at the 38th annual meeting of the New England Association of Gas Engineers we said that Mr. Allen was elected First Vice-President, and that Mr. Snow was chosen Second Vice-President. The fact is the gentlemen named were elected in just the reverse order.

MR. F. W. STONE, Manager of the Ashtabula (O.) Gas Company, writing under date of the 3d inst., says:

To the Editors AMERICAN GAS LIGHT JOURNAL: I notice in your issue of March 2d that the officers of the Noblesville (Ind.) Gas and Improvement Company claim theirs to be the banner Company in the matter of ratio of consumers to population. Their 1,221 consumers to 6,000 population give to them a ratio of one consumer to each 4.91. Fearing they might think they had reached the limit, I thought I would call their attention to some Companies that happen to be under my supervision.

Ashtabula, O.: 3,817 consumers to 18,000 population; or one consumer to 4.71 population.

Greenville, Pa.: 1,718 consumers to 6,000 population; or one consumer to 3.51 population.

Jamestown, Pa.: 234 consumers to 800 population; or one consumer to 3.57 population.

I have no doubt that there are other gas companies having a better proportionate showing than the above; but these will do for a starter.

THE next meeting of the New York Section of the Illuminating Engineering Society will be held in the United Engineering Societies' Building, at 8:15 the evening of March 12th. Secretary Millar informs us that the paper of the evening is to be read by Mr. E. L. Elliott, whose subject is "The Relation of Illuminating Engineering to Architecture from the Engineer's Standpoint." This in reality will be the continuation of a discussion had at the December meeting of the Society, at which time a paper on the same subject was presented by Mr. Bassett Jones, Jr.

THE Home Gas Company, of Salisbury, Md., reports that its demonstration lessons on gas for cooking, which were given the last 3 days of February, were surely the talk of the town. The Company kept open house in its well appointed offices from 10 A.M. to 9 P.M.

THE taxes paid into the city treasury on all accounts for the year 1907 by the St. Paul (Minn.) Gas Light Company amounted to $100,000. By far the larger part of this sum became payable through the operation of the agreement between the city and the Company under which the latter is required to pay over to the former the sum of 5 per cent. per annum of its gross earnings.

MR. F. S. BRUMMAGIM has been appointed Assistant Manager of the La Salle (Ills.) Gas and Electric Company. In addition to his duties as General Manager of the Citizens Lighting Company, of La Salle, he has been assigned to take up the duties of Superintendent of the Illinois Valley Railway.

THE Trustees of the municipal gas works at Wheeling, W. Va., will expend $100,000 this year on betterment account, provided the voters indorse the proposed scheme at an election to be held this spring.

The "Readiness-to-Serve" Cost of Gas Supply.

[A paper prepared and read by MR. W. H. GARDINER at the Thirty-eighth Meeting, New England Association of Gas Engineers.]

It is now generally recognized by managers, by the courts, by commissions, and by a large proportion of the thinking public, that "load factor" systems of charging for electrical supply are reasonable, equitable and desirable. While this class of rates is generally based upon the most accurate analyses of costs we have as yet evolved, their desirability, to both the public and the supplying corporations, rests upon the fact that through them the central station can supply, from a given capacity, a larger volume of service at a lower average price per unit than when using any other systems of charging based supposedly only on total cost of production. The main reason for this is that "load factor" rates make for the maximum gross income per annum per dollar invested in equipment; this, by raising the divisor of all fixed charges and expenses, allows of minimum average prices, and, for the same reason, of maximum net earnings per dollar invested, other things being equal.

But when the question of almost any differential price, and especially any "load factor" system, is raised in connection with gas supply, the answer from both laymen and gas managers usually is in substance: "Of course, that's all very proper and necessary for electricity, but the gasholder removes the need of anything but the uniform price by meters or the quantity discount principle for gas." It has indeed often seemed to me that the physical dimensions of the gasholder are so great, and it is so near to the eye of the observer, as to entirely obscure his view of his winter manufacturing capacity and of his mains, services and meters.

In this paper my endeavor will be to establish by analogy and argument the prominence of "readiness-to-serve" costs and the comparative unimportance of the holder. If I succeed in this the propriety of a "readiness-to-serve" rate or a "load factor" rate for gas will be evident.

In an epoch making presidential address, delivered November 4th, 1892, before the Junior Engineering Society, in England, the late Dr. John Hopkinson set forth the principles of "load factor" costs and rates as applied to electrical supply. He says, in part:

"You are all familiar with the fact that the expenses of an undertaking may be broadly divided into two classes. On the one hand, there are expenses which are quite independent of the extent to which the undertaking is used; and, on the other, expenses which are absent unless the undertaking is used and which increase in proportion to the use.

"The actual importance of considerations of this kind can only be realized by examining figures. The figures may as well be estimated figures, because the circumstances vary from one neighborhood to another. No criticism of the details of the figures will affect the general character of the conclusion. Let us, then, imagine a station capable of supplying 40,000-candle power lamps at one time, with mains and spare machinery enough to insure that the supply shall not fail, and let us see what the charge for running such a station will be. First, on the hypothesis that it is always to be ready to supply the 40,000 lamps at ½ hour's notice, day or night, but that all the lamps are hardly ever actually required; secondly, on the hypothesis that the 40,000 lamps are steadily and continuously supplied day and night. These are the two extreme cases possible. In the former the load factor is *nil;* in the latter it is 100 per cent. If the charge is by meter at 8d. per unit, in the former case the revenue will be *nil;* in the latter it will be £730,000 a year.

"We are going to divide the cost of supplying electricity into two parts—a part which is independent of the hours the supply is used, and a part which is directly proportional thereto, and we are going to estimate the amount of each element. It is for the purpose of ascertaining these elements that we consider two quite hypothetical cases which can themselves never actually occur."

He then assumed an investment of £145,000, and arrives at the following statement, after having used interest and depreciation rates, which experience has shown to be too low, especially in America:

TABLE I.

	Running Light.	Fully Loaded.
Fixed charges	£16,410	£18,750
Coal	6,000	30,000
Stores	600	3,000
Wages	5,500	7,700
	£28,510	£59,450

From this he concludes that the total annual "readinesst-o-serve" cost, composed of fixed charges and fixed operating expenses, would be about £28,000, while the additional cost due to, and varying approximately with, actual production of current, would be but about £31,000 out of a total about £59,000 of annual cost with the plant running at full load every minute of the year.

After stating that—

"The charge for service rendered should bear some relation to the cost of rendering it."

and—

"The ideal method of charge, then, is a fixed charge per quarter proportioned to the greatest rate of supply the consumer will ever take, and a charge by meter for the actual consumption,"

he used this prophetic language:

"It is obvious that those whose use is long will find the electric light economical to themselves and that it will be profitable to the undertaker. With a cheap light there will be extensions for the hours of use. Shops may find it worth while to continue the light after closing, as an advertisement."

In conclusion he said:

"It is possible, indeed probable, that some of my assumed figures may be shown to be too high or too low for the generality of cases. It is of no moment; let each one take any figures he pleases within reason; let him assume that the supply of electricity is made by any system he pleases; he will arrive at a result broadly similar to mine. To be ready to supply a customer with electricity at any moment he wants it will cost those giving the supply not much less than £11 per annum for every kilowatt, that is for every unit per hour, which the consumer can take if he wishes; and afterwards to actually give the supply, will not cost very much more than ½d. per unit. This is the success of electric supply. It is hopeless for electricity to compete with gas in this country all along the line if price is the only consideration. But with selected customers electricty is cheaper than gas. Surely it is the interest of those who supply elcetricity to secure such customers by charging them a rate having some sort of relation to the cost of supplying them."

Such are the essential points of one of the earliest but also one of the most able electrical cost and rate papers. While many very able modifications have since appeared, the principle therein first set forth stands to-day.

Let us now consider a gas company whose equipment is capable of generating not over 1 million cubic feet every 24 hours. Let us pay particular attention to the storage function of its one holder, which we assume is at the works. We will consider only the relations between the plant and its year's work, without regard to the variations of output from day-to-day, since obviously the excess capacity over the small demands for summer output cannot be utilized to make and store gas for winter distribution. In a gas plant the maximum day's demand determines the combined dimensions of generating and storage capacity required. Therefore, we will use the maximum day's chart. In the following chart, which we will suppose illustrates this, the maximum rate of taking gas for 1 hour (and any moment thereof) is 125,000 cubic feet, and if sustained for 24 hours would require generating capacity equal to 3 million cubic feet; but the assumed capacity and sales were 1 million feet total for the maximum day.

Let us allow it 122,000,000 feet as annual commercial sales.

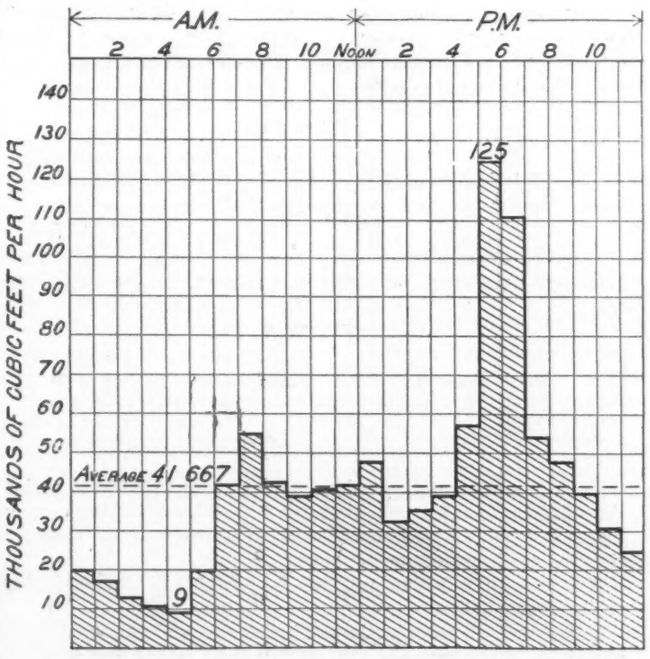
As investment necessary in this plant under normal conditions we will assume the following:

TABLE II.

Real estate	$216,000
Machinery	225,000
Holder	75,000
Mains and services	330,000
Meters	49,000
Sundry equipment	3,000
Materials and working capital	102,000
Total	$1,000,000

At the outset I implied that the holder was the main obstruction to our vision or stumbling block to our footsteps on the road to right rates.

In most cases let us, therefore, remove it bodily and run without it, saving $75,000 from the schedule of Table II. But as our maximum hour's (and moment's) rate of taking is at the rate of 125,000 cubic feet per hour, equivalent to 3,000,000 cubic feet daily,



Hypothetical Maximum Day's Sales, Showing Hourly Rates of Consumption.

we must provide generating machinery of 3,000,000 cubic feet daily capacity. This will raise our machinery item from $225,000 to $675,000. Our investment will, therefore, stand as $1,000,000 — $75,000 + $450,000 = $1,375,000.

We have now a plant capable of supplying gas at the maximum hourly rate demanded (125,000 cubic feet) and reduced to the same prime factors as an electric plant without batteries. Let us analyze it as Dr. Hopkinson analyzed his electric plant. Consider two extreme hypotheses: First, that the plant is maintained with heats up and gas at every customer's meter but that no gas is being taken; and second, that it is delivering at its maximum rate of 125,000 cubic feet per hour for every hour of every day in the year - running at 100 per cent. load factor and selling 1 billion and 95 million (1,095,000,000) cubic feet per annum. What will be the total annual costs in the first case with everything ready but no commercial output?

What will be the total annual costs in the second case with the output at 100 per cent. of the capacity?

How much will actual production and delivery cost over being merely ready to make and deliver the gas?

Assuming that the latter output cost varies directly with the output, what would an annual commercial output of 122,000,000 feet cost?

Assume taxes as $15 on the $1,000, a rate of 6 per cent. for interest and, for the sake of simplicity, an average depreciation of 4 per cent. when merely ready to output, but not outputting while an average depreciation of 6 per cent. when outputting the maximum continuously. For maintenance repairs allow likewise an average on the whole of 4 per cent. when but ready to output and 6 per cent. when outputting.

Because of our equipment costing $1,375,000 we would have the following statement of fixed charges for our two hypotheses:

TABLE III

	Ready for Output.	Outputting.
Taxes	$20,625	$20,625
Interest	82,500	82,500
Depreciation	55,000	82,500
Maintenance	55,000	82,500
	$213,125	$268,125
Say,	213,000 and	268,000

At 10,000 cubic feet per ton, it would require to generate 1,095,000,000 feet of gas 109,500 tons of coal, which at $2.50 per ton would be $273,750. Adding 10 per cent. for sundry materials would make the total material expense $301,175, say $301,000 when the plant is outputting its maximum continuously. Let us assume that all materials necessary to maintain the complete readiness to output conditions amount to about 15 per cent. of the maximum use of materials, say $45,000.

To the pay roll we may assign $60,000 for the maximum conditions and assume the low proportion as but one-half as necessary to maintain complete readiness-to-output. The material and labor expenses could then be stated as follows:

TABLE IV.

	Ready to Output.	Outputting.
Materials	$45,000	$301,000
Labor	30,000	60,000
Totals	$75,000	$361,000

Summarizing all the annual costs we would then have the following:

TABLE V.

	Ready to Output.	Outputting.
Fixed charges	$213,000	$268,000
M. and L. expense	75,000	361,000
Totals	$288,000	$629,000

Now, to answer our questions. It will cost $288,000 to maintain the plant in complete readiness to serve without making any commercial output. It will cost $629,000 to be ready and to output continuously at its maximum capacity.

The actual production and delivery of 1,095,000,000 cubic feet of gas will cost $341,000.

To be ready to serve at the maximum rate and to output actually one-ninth of the capacity (122,000,000 feet) would cost $316,000—a readiness-to-serve cost of $288,000 and an output cost of $38,000.

For comparative purposes with our next hypotheses I might here state that this first plant, running on a one-ninth load-factor, would have to charge at a uniform rate by meter $2.59 per 1,000 to exactly split even; or it might charge an annual readiness-to-serve charge (in monthly instalments) of $2.30 per cubic foot of maximum hourly rate of taking plus a uniform rate by meter of 31 cents per 1,000 actually taken.

I believe that in the above-stated hypothetical case the theory of readiness-to-serve costs and outpnt cost is as logical for gas as Dr. Hopkinson made it for electricity; but, it will be objected, I have hypothecated the storage holder out of existence. How about this holder which was to annihilate all load-factor theories and their dependents?

Let us revert to our original plant, as scheduled in Table II., with a $75,000 holder of 750,000 cubic feet capacity, and $225,000 worth of generating machinery capable of making not over 1,000,000 feet a day at the maximum rate of 41,667 feet per hour, but because of its holder capable of outputting at the maximum hourly rate of 125,000 feet, as assumed also in our first hypothesis. Retaining all secondary hypotheses we will repeat our line of argument.

Because of our equipment now costing but $1,000,000, we would have the following statement of fixed charges for running at no load and at full load.

TABLE IIIa.

	Ready to Output.	Outputting.
Taxes	$15,000	$15,000
Interest	60,000	60,000
Depreciation	40,000	60,000
Maintenance	40,000	60,000
Totals	$155,000	$195,000

As we can generate but 365 million feet of gas a year at constant full load (one-third of the output in our first hypothesis) we can set our material expense down as $15,000 for running light and $100,000 for running at full load, instead of $45,000 and $301,000, respectively, as in our first hypothesis. As our generating machinery, the principal part of our works, is now of but one-third the capacity assumed in our first hypothesis, we will simply cut our pay rolls by two-thirds. Our material and labor expenses would then appear as follows:

TABLE IVa.

	Ready to Output.	Outputting.
Materials	$15,000	$100,000
Labor	10,000	20,000
Totals	$25,000	$120,000

Summarizing all the annual costs we would now have the following:

TABLE Va.

	Ready to Output.	Outputting.
Fixed charges	$155,000	$195,000
M. and L. expenses	25,000	120,000
Totals	$180,000	$315,000

To answer the questions stated at the outset of our argument for our last hypothesis, as we did for our first:

The readiness-to-serve cost is $180,000; the total cost of full load is $315,000; the maximum output cost is $135,000.

If the plant were ready to deliver at its maximum, and actually delivered one-third of its possible output, the readiness-to serve cost would be as above, $180,000, and the output cost $45,000—or a total of $225,000 for 122,000,000 cubic feet. Let us compare our two cases as follows:

TABLE VI.

	First Case. Without Holder.	Second Case. With Holder.
Maximum hourly rate, capacity and demand	125,000	125,000
Volume of commercial sales	122,000,000	122,000,000
Investment	$1,375,000	$1,000,000
Readiness-to-serve cost	288,000	180,000
Output cost of 122,000,000	38,000	45,000
Total annual costs	316,000	225,000
Average total cost per 1,000 cubic feet	2.59	1.84
Annual readiness-to-serve charge per cubic foot of demand per hour	2.30	1.44
Additional consumption charge per 1,000 by meter	0.31	0.37

What effect has the introduction of the holder had upon the annual costs? By making unnecessary $375,000 worth of peak generating capacity it has reduced the readiness-to-serve cost from $288,000 to $180,000 per annum. But it has not destroyed or in any way vitiated the readiness-to-serve theory. To emphasize this, let me develop our second case - the one including the holder—one step further by a final hypothetical comparison.

We have heretofore considered it as selling 122,000,000 feet at various rates of output up to its maximum capacity of 125,000 feet per hour, thus operating on a load factor of 33.3 per cent. Retaining the same equipment, investment and readiness-to-serve cost of $180,000, and the maximum rate of production and demand as fixed at 125,000 feet per hour, let us merely change the load factor up and down by merely increasing and decreasing the volume of actual commercial output.

First, let us drop the sales from 122,000,000 feet per annum to 100,000,000 feet; and, second, let us raise them from 122,000,000 feet to 144,000,000. As our actual output costs us essentially 37 cents per 1,000, we can draw the following comparison:

TABLE VII.

	Selling 100,000,000.	Selling 144,000,00.
Maximum hourly rate, capacity and demand	125,000	125,000
Readiness-to-serve cost	$180,000	$180,000
Output cost at 37 cents	37,000	53,280
Total annual costs	217,000	233,280
Average total cost per 1,000	2.17	1.62
Load factor	27.4 pr. ct.	38.5 pr. ct.

Without going into the question of a proper method of charging, let us assume that we were charging merely a uniform rate by meter of $1.84 (the exact average cost per 1,000 when selling 122,000,000 on a 33.3 per cent. load factor, as per Table VI.) If our sales dropped to 100,000,000 (dropping our load factor to 27.4 per cent.), we would save $8,000 of costs, but would lose $40,480 of gross revenue—a net loss of $32,480.

But if our sales increased from 122,000,000 to 144,000,000 (raising our load factor to 38.5 per cent.), our costs would increase but $8,280, while our revenue would increase by $40,480—a net gain of $32,200. In view of this, it would be difficult to find any close relation between our costs and our charges if based solely on the average cost per 1,000 and the uniform rate by meter. But if, under our hypothesis, we had charged $1.44 per annum per cubic foot per hour of maximum rate of taking, plus 37 cents per 1,000 actually taken, our charges [illegible] would have coincided with our costs at every load factor.

If all the foregoing statements, hypotheses and comparisons have made clear the readiness-to-serve theory, I think we can formulate the following conclusions:

1. That the cost of gas supply may properly be separated as readiness-to-serve costs and as output costs.

2. That the "load factor" theory of costs and rates is applicable in principle to gas supply

3. That a storage holder at the works merely minimizes the investment in generating capacity and the costs of maintaining and running the same, but does not eliminate or subordinate the readiness-to-serve costs.

4. That as a holder at the works does not assist the mains, services and meters as it does the generating capacity, all apparatus between said holder and the customers' burners must be ample to meet the aggregate and individual maximum momentary demands as in an electrical equipment without storage batteries.

5. But that, if in addition to the holder at the works there are one or more outlying holders, these play essentially the same functions as outlying storage battery sub-stations do in an electric plant.

I will not from the foregoing here elaborate a rate system or point out the relative costs and values of short-hour and of long-hour customers. Dr. Hopkinson and many more recent electrical analysts have made clear these principles. Nor will I here attempt any distinctions in the readiness-to-serve costs as between customer costs and demand costs. Mr. H. L. Doherty and Mr. F. W. Frueauff have done this for both gas and electricity. I stop short of these important points because I wished to center the discussion on the readiness-to-serve costs as a whole and the additional output costs; in other words, the costs, first, of getting completely ready to render service and then, of using the facilities prepared to furnish complete service. As all figures used have been arbitrarily assumed merely to illustrate relations, no figures herein are of any value or subject to discussion excepting as illustrating the theory of certain relations.

Since writing the above section of this paper, a gas and electrical manager of great experience made the criticism to me that, while he thought that in it I had made clear the theoretical relations of the readiness-to-serve costs to the output and total costs, nevertheless my illustrations, first, of a plant without a holder, and, second, with a holder, but illustrated the opinion that the readiness-to-serve costs are much less important in gas supply than in electrical supply.

Whether or not this is the case does not in the least affect, in my opinion, the soundness of the theory or the basic importance of it to the gas business. It matters not whether under average conditions the readiness-to-serve costs are 40 per cent. of the total for gas and 60 per cent. for electricity, or whether they are 60 per cent. for gas and 40 per cent. for electricity. In fact, in isolated cases they might well vary over even greater ranges for either gas or electricity. However, the discussion which ensued brought out points to which he agreed and which seem worthy of briefly summarizing here. To make them clear we may assume, as is not far from the facts, the following hypothetical relations of investment and revenue for gas and for electricity:

TABLE VIII.

	Gas.	Electricity.
Annual gross revenue	$20	$20
Generating and storage investment	40	40
Distribution and meters investment	40	40
General investment	20	20
Total investment	100	100

Let us separate the works of each business from the distributing equipment beyond the works and compare the analogous departments.

If the principles I have stated in my paper are sound, we can dismiss considerations of the distributing departments with merely the statements that when a gas company has its storage capacity entirely at the works the distributing system is essentially analogous to that of an electric company, and its dimensions are governed by the maximum momentary aggregate demand; when there are outlying holders these play the same functions as storage battery sub stations. It is, however, in the works that misunderstandings may arise. We assumed that to produce $20 of annual revenue a total investment of $100 was necessary. If this be electricity, $40 of it is in generating stations and machinery. If it is for gas, $40 out of every $100 invested is in gas works and generating capacity and in gas storage capacity.

Now, wherein is the difference, if any? In electrical supply we put $40 in direct generating capacity, and do not use storage batteries to any large extent at the works, because their large initial cost, rapid depreciation and inefficient operation cost in total more than the total possible saving from displacement of peak generating capacity which batteries would make possible.

In gas supply we put $40 into gas works generating capacity and storage capacity combined. Treating this combined works and holder as a unit, wherein is this $40 invested in gas generating and storage capacity different from the $40 invested in direct electrical generating capacity? I fail to see any essential difference, and in my opinion the readiness-to-serve cost for gas generation and storage would be just about as important in this case as the readiness-to-serve cost for direct electrical generating capacity. In gas we have a cheap and efficient means of storage, and use it because it saves us from putting in over three times as much generating capacity. The fact would seem to be that this comparatively cheap and efficient means of gas storage really saves the gas business from having the readiness-to-serve costs at least twice as important to it as they are to the electrical business. To make this clear, assume that of our $40 invested in gas works and holder, $30 is in generating capacity and $10 is in storage holder capacity.

In the chart given in my paper (which chart was drawn from readings taken last December) the maximum hourly rate of consumption (125,000 cubic feet) happens to be just three times the average hourly rate and capacity of generation (41,667 cubic feet), and the actual maximum momentary rate of consumption may very likely be in practice four or more times the average rate of generation. Assume it as four times the latter rate. Then, were it not for our friend the holder we would have to put in say four times the generating capacity in order to meet our peak demand. This would mean that instead of investing $30 in generating capacity and $10 in storage capacity we would have to invest $120 in direct gas generating capacity.

The following table would then illustrate the relation of gas investments and readiness-to-serve costs to their electrical analogues:

TABLE IX.

	Gas.	Electricity.
Annual gross revenue	$20	$20
Generation and storage investment	120	40
Distribution investment	40	40
General investment	20	20
Total investment	180	100

Instead, therefore, of as at present in practice requiring about the same total investment in either gas or electricity to obtain a given gross revenue, it would require nearly twice as great an investment for gas as for electricity. This, together with the great inefficiency which would result from operating four times the present gas generating apparatus, would, I think, make the total readiness-to-serve costs over twice as important in the gas business as they are in the electrical business.

We may, therefore, conclude that in the case and under the figures assumed the holder has not made the readiness-to-serve costs of gas supply relatively less important than the readiness-to-serve costs of electrical supply, but has merely prevented them from being say twice as important in gas as in electricity. A collateral conclusion from this argument is that to produce a given amount of commercial product or revenue, gas generating apparatus is about three times as expensive to install as electrical generating capacity.

I realize fully that all of the relations I have discussed depend for their relative importance each to the other on the figures assumed. Some of the general ones used may not be far from average conditions; others have been taken arbitrarily, and this has been done with the intention of preventing the use of any figures herein in connection with any specific case. Whether any or all of them are high or low, right or wrong is of no moment, and is not a subject for discussion.

I have tried merely to make clear certain theories and relations, the recognition and use of which have been of vital assistance to the users and to the producers of electricity. I believe that to a relatively greater or less extent their recognition and use may be of like service to the users and to the producers of gas. Furthermore, I have in this paper purposely omitted to make any mention of many important but minor modifying and contributing factors. Throughout I have endeavored to treat only with the primary factors or skeleton of the readiness-to-serve principle in the hope that what seems to some to be a vastly intricate matter might be more readily appreciated in its primary form.

Distribution Notes.

[A paper prepared by Mr. H. H. Kelly, Waltham, Mass., for the Thirty-eighth Meeting, New England Association of Gas Engineers.]

It is exceedingly gratifying to every gas manager to know that his business shows a constant increase and to me the study of an increase is interesting and of value, for by it one may determine to his satisfaction whether it comes by an effort of his, a reduction of price, the sale of gas-consuming appliances, an increased use of gas by manufacturers and ordinary consumers, or by the extension of mains into new territory.

As all data presented is from the company with which I am connected, it may not seem as interesting to you as it does to me. I have used figures relating only to the period of time from 1901 to 1907, inclusive, shown on chart herewith. The chart shows comparative day distribution, the per cent. of gain and per cent. of day distribution to total.

Per Cent. of Day Distribution to Total in

1901, 34.9	1904, 41.5	1906, 46.1
1902, 37.8	1905, 47.2	1907, 47.6
1903, 39.8	....	....

Per Cent. of Gain in

1902, .33	1904, 17.2	1906, 6.4
1903, 26.2	1905, 25.5	1907, 15.

Night Distribution—Gain, Per Cent.

1902, 16.8	1904, 9.1	1906, 11.4
1903, 16.7	1905, .6 loss	1907, 8.5

Price of Gas, Net.

1901, $1.35	1904, $1.25	1906, $1.15
1902, 1.25	1905, 1.20	1907, 1.10
1903, 1.25	....	....

Gas Ranges Sold.

1900, 71	1903, 246	1906, 361
1901, 117	1904, 253	1907, 361
1902, 283	1905, 243	....

And during this time we laid 7½ miles of mains in new territory.

Meters Gained as Follows.

1901, 146	1904, 294	1906, 366
1902, 257	1905, 266	1907, 371
1903, 253	....	....

In July, 1902, we made satisfactory arrangements with a large manufacturing establishment that increased our day distribution from that time, as you will see. Our factories, as a rule, close a part of July for a vacation; in 1907 the vacation was in August.

April seems to be the month that does not show up well on day distribution, while the months of June, July, August and September show that gas ranges and water heaters should have the credit. The per cent. of day to total distribution for these 4 months is:

1902, 43.8	1904, 49.5	1906, 54.9
1903, 48.3	1905, 54.	1907, 57.2

Through the courtesy of the treasurer of the Company of which I am superintendent, I submit an analysis of gas consumers for the calendar year 1906, compiled by him. This does not include the city or corporations.

11	per cent.	of the	consumers	use	less	than	6,000	feet	or 2	per cent. of gas sold.
24	"	"	"	"	"	6 to 12,000	"	12	"	"
26	"	"	"	"	"	12 " 18,000	"	21	"	"
17	"	"	"	"	"	18 " 24,000	"	19	"	"
8	"	"	"	"	"	24 " 30,000	"	11	"	"
7	"	"	"	"	"	30 " 42,000	"	12	"	"
4	"	"	"	"	"	42 " 60,000	"	9	"	"
3	"	"	"	"	"	over 60,000	"	14	"	"

Average sold per customer, 19,390 feet.

This accounts for the sale of 50 million cubic feet. Our gain in gas sold per capita, from 1902 to 1906, taken from the report of the Board of Gas and Electric Light Commissioners, was 1,148 feet, or 73 per cent., which was fourth in a list of 31 companies, and only one supplying a population equal to ours or smaller showed a larger percentage. These figures are not supposed to show any abnormal growth, but do show a good, healthy increase.

How Far Should a Gas Company go to Maintain the Efficiency of Gas Appliances.

[A paper prepared by Mr. J. C. D. Clark, for the National Commercial Gas Association.]

I believe that no intentional limit or strict interpretation has been placed upon the word "efficiency" or the word "appliance." There is, therefore, in its broadest sense, no limit where a gas company can profitably stop in its efforts to maintain its efficiencies.

If we attempt to narrow the word "appliance," and compress the subject into the narrow range of the common acceptance of the word, we are driven back into the retort by the necessity of having a commercial gas, of uniform quality, under proper and constant pressure, in order to maintain anything like efficiency in the appliance. Given a good commercial gas the next thing is to burn it efficiently. J. M. Morehead, Chief Chemist of the Peoples Gas Light and Coke Company, Chicago, has the following to say on the burning of gas:

Burning, as ordinarily known, is a combustion of a fuel with oxygen. In the case of a few bodies, such as explosives, the oxygen is furnished by some chemical substance containing oxygen and intimately mixed with the fuel. In gunpowder the fuel is carbon and the oxygen giving substance is saltpeter; but in the vast majority of combustion, taking place with either solid, liquid or gaseous fuels, the oxygen comes from the air. Air consists of practically 20 parts of oxygen to 80 parts of nitrogen. The completeness of a combustion, or the efficiency of conversion of any fuel into heat, depends upon the proportion and the thoroughness of the mixture of the fuel with the air supplying the necessary oxygen. In any combustible substance a given portion of the fuel will combine with just so much oxygen, no more and no less. If an excess of air is added the fuel combines with just a definite amount of the oxygen and the excess of oxygen is unaffected and goes on through the flame, together with its nitrogen, which results in cooling the flame and lowering the efficiency of combustion. If on the other hand a deficit of air is provided, as much of the fuel as there is oxygen for will be consumed, while the balance of the fuel will pass out of the flame unconsumed; this also lowers the efficiency of combustion. This is very evident when the draft of an ordinary lamp chimney is shut off. Portions of the fuel which are unconsumed then pass off in the shape of soot.

Each particular form of fuel (solid, liquid or gaseous) requires a certain proportion of air for its complete combustion. Ordinary illuminating gas requires about 12 cubic feet of air per cubic foot of gas consumed. The proportion of air and gas necessary for combustion at the point of maximum efficiency is, as stated, 1 of gas and 12 of air, and it is to insure this proportion that "mixers" are provided on gas burning appliances.

When illuminating gas is burned for light in an open flame burner the light is obtained by supplying the air only to the outside of the flame. When the gas on the outside is consumed, the heat resulting from the combustion raises the carbon particles in the unconsumed portion of the gas to incandescence, and these incandescent particles of carbon give rise to the light. This is a rather inefficient method of burning gas for either light or heat.

If gas is consumed for heat it is more efficient to mix the air with the gas before the gas reaches the point of ignition than it is to require the gas to find its own oxygen after it leaves the burner. If the air is previously mixed in this way combustion takes place all through the mass instead of only on the surface.

If it is desired to obtain light, a permanent substance, such as a mantle on an incandescent burner, may be suspended in the flame where all of the gas is consumed for heat in the most efficient way and the substance of the mantle takes the place of the particles of the carbon in the open flame. By this method from 3 to 6 times the amount of light is obtained with the combustion of a given amount of gas. If it is desired to burn the gas for heat the same arrangement is adopted. Then the flame temperature of the mixture of gas

and air is from 1½ to 3 times as high as the flame temperature of the gas burned in air and required to find its own oxygen.

This enormous increase in efficiency of a gas when used for either light or heat depends upon the fact that the air is mixed with the gas before the gas reaches the burning or ignition point, and further upon the proportions and thoroughness of the mixture of the gas with the air.

In the above explanation of the burning of gas is disclosed the mission of the gas appliance. No appliance that is made by man is self-adjusting, self-cleaning, or self-renewing, whether used for light, heat or power; so it is reasonable to assume that some attention is required by all appliances to maintain efficiency. How far gas companies should go to maintain gas appliance efficiency is a very important question. We are all familiar with the trouble we have with all appliances, and there does not seem to be much use in complaining about existing conditions unless a remedy is suggested.

The following suggestions are set forth for your consideration: The National Commercial Gas Association to recommend to the American Gas Institute the appointment of a committee (composed of 3 members of the National Commercial Gas Association and 3 members of the American Gas Institute) to devise a way or means toward the installation of a permanent testing laboratory where all gas appliances coming on the market might be thoroughly tested by competent men, to be known as the "Board of Gas Appliance Examiners."

It would be proper for them to give, in pamphlet form, their recommendations regarding the installation and operation of the appliances tested by them, and, so far as possible, have this pamphlet accompany the appliance. It could be gotten up in such a manner as to be acceptable to the manufacturers and those concerned in its sale.

This pamphlet would serve as an educator to the salesmen, installer and customer. The Board could in time establish a standard for all gas burning appliances. Their work would go a long way toward encouraging the manufacturer inclined to build good appliances, and would tend to discourage the sale of worthless appliances.

The Board should compile an illustrated pamphlet or book, showing, by simple diagrams, etc., the principles involved in the use of gas, precautions necessary to secure the best results and in maintaining them and giving a brief and effective statement of the advantages of gas over other sources of heat and light. Every gas user should be provided with a copy, and, if practical, a monthly pamphlet should issue.

It seems to me that such a distribution of knowledge would more than repay the cost of publication, etc., in the increased satisfaction of the customer, who now blames the gas for all the trouble he has with a gas appliance the operation of which he only half understands.

What a splendid thing it would be for gas companies if they had absolute control over all the gas appliances that are used on their lines. Some companies throughout the country rent cooking appliances, others rent lighting appliances, and in this way have control over them.

Another plan to obtain control of appliances is to see to it that the new appliances that are installed on these lines are constructed along the right lines, then, by a system of inspection, seeing to it that they are kept in good order and that they are giving good satisfaction.

Gas companies should co-operate with the gas associations by bearing part of the expense of the Board of Gas Appliance Examiners; should purchase from the Board such pamphlets as are published, and place a copy in the hands of each gas user; should purchase only such appliances as are approved by the Board; should connect all appliances in accordance with instructions that accompany appliances (unless local conditions interfere); should employ competent mechanics to install all appliances; should instruct their customers how to operate, clean or adjust the appliance installed for them, also educate the customer to know the signs of poor combustion, draft, etc.; should make a systematic inspection of all gas burning appliances that are connected on their lines to insure safety, to insure hygienic conditions, to insure efficiency; should establish a maintenance department for the purpose of maintaining such appliances as need regular and constant attention to maintain efficiency, charging such fees as seem fair for the service rendered.

It has always been a problem with gas companies to keep a sufficient number of good mechanics at work all the year round. When the work is slack mechanics are laid off, and take up other employment, then a green man has to be broken in when a busy time come on.

Would recommend that the commercial department so plan this work that the mechanical department is kept busy all the year round, and that during August of each year the town be divided into sections, and all the mechanics that can be spared started in a house to house inspection of appliances, to clean and adjust fuel appliances, clean or renew flat flame burners, clean, adjust or renew mantle burners, no charge to be made for cleaning or adjusting appliances. Charge only for material used, and at the time inspection is made arrange with the customer for a regular inspection—say once a month—charging a nominal fee to cover the cost of labor and material. In this way you will be as far as it is practical in control of the customers' appliances.

The Personality of the Salesman.

[An address delivered by MR. J. D. KENYON before the National Commercial Gas Association.]

Gentlemen: I deeply appreciate the opportunity to talk to you upon a subject which I consider the most important one that can be considered by this convention—that of the personality of the salesman. Only within the last few years has this important subject received much consideration at the hands of those in the gas business. A few years ago gas was only considered for its use for lighting purposes, and being a public commodity, it was thought all that was necessary to do was to put up a plant and the public would come after the supply.

When electricity commenced to come into general use, and much of the business formerly retained by the gas companies was getting away from them, they commenced to wake up to the necessity for going out after business. As the inventive genius of many men was directed to the developing of appliances for the use of gas in a commercial way and in the homes of people, there was forced upon the attention of those who were running the gas business the necessity for getting closer in touch with customers and prospective customers, cultivating them and educating them into a greater use of gas. Many new industries sprang up and commenced to do a large business with the various appliances for the use of gas, and the doors of opportunity were opened wide to the wise managers of gas companies. The necessity for the sales' organization, able to go after business and convince people of the merits of gas in various applications, was made apparent. Companies commenced to put in new business departments and to build sales' organizations, realizing that the greatest profits to the concern would come from business which they would have to go after and which would not naturally gravitate to them.

While most companies had spared no pains or expense in equipping their plants for the production of gas, many of them hesitated, and are still hesitating, in correctly organizing the business getting department, not realizing that therein lies their greatest opportunity. Those, however, who did become busy in organizing such a department, commenced to realize that there were many conditions to confront and obstacles to overcome. They found several classes of customers and prospective customers. As an illustration:

1. They found people who really were convinced of the value of a gas proposition, but were simply waiting for someone to call upon them to secure the business. Of course, it does not require a very strong man to get this business. An order taker can do it, but the percentage of business of this kind is very small.

2. Those who think the proposition is all right, as far as its value is concerned, but wish to haggle over prices, terms, etc. A stronger man is required there.

3. Those who have some desire, but who have not decided to purchase, due, perhaps, to a lack of belief in the real value of the product to them. A stronger man is needed there.

4. Those who have no desire whatever for the product, but really need it, though they think they do not. The strongest kind of a man is needed there.

In employing men companies found the real strong, successful business getter exceedingly scarce. As a rule he is already employed and too busy to be looking for another job. Therefore, the companies had to take the best they could get, and soon saw some system of education was necessary. Many of them tried to solve this problem by drilling the men in technical knowledge, but experience has proven that this falls far short of solving the problem, although it is about as far as a manager can go with his own men. A closer knowledge of the situation reveals the fact that the most vital factor in salesmanship is the personality of the salesman; and why is this true?

Confidence is the basis of all trade. If a salesman cannot inspire

confidence in himself, he cannot inspire confidence in his goods or in the product he sells or in the company he represents. Confidence is inspired through personality. Personality is not simply good looks or good clothes. It is the product of the positive faculties—mental, moral and physical. A close study of this subject reveals the fact that the salesman must have a marked development in physical endurance, in ability to think, in reliability and action. To possess endurance he must know how to live in harmony with the laws of health. He must know how to exercise right, eat right, breathe right, think right. Very few men have the endurance they should have in business, due to the fact that they do not know how to do these things correctly. Therefore, a study of this very important subject adds greatly to the value of any individual.

Ability is a product of the faculties of the mind which operate for the production of thought. Observation is the basis of all thought. Through our five physical senses every idea comes into our mind. Very few men have these senses acutely trained, but where you find such a man you find one full of ideas, because he is in touch with the things that are around him and is constantly absorbing knowledge. Men must be taught not only to look but to see; not only to hear but to understand. The unobservant, heedless man is bound to be an indifferent man, one who is incapable of having many ideas or of influencing people to any extent.

Memory is another very important factor that enters into the personality of the salesman. He must not only have the faculty of observation keenly developed, but he must have a well developed memory, so that he can recall the impressions he has received and work them up into ideas, which, through his reason and judgment, can be converted into dollars.

Concentration is a faculty required by the salesman to a marked degree. He must have the ability to throw all of his force and strength into that which he undertakes. The man with scattered ideas is a man who accomplishes very little.

Imagination is a very essential faculty in the personality of the salesman. It is the creative force of the mind. It is that part of the mind which takes the ideas which are brought into consciousness through the faculties of observation, of memory and reason, and works them up into new ideas and new ideals. It is that part of the mind which does the planning, which stimulates one to higher things by picturing the way for him. The salesman's imagination must see how to plan his day's work, his week's work, his year's work and his life's work; and again, it is through his imagination that he is able to cause his customers to see the advantage of the use of the product he sells. If the mental picture of the value of his proposition is a poor one in his own mind, it is bound to be a very poor one which he transplants to the mind of the prospective customer. He must make his customers actually see the advantage of the product to himself. Great men are always men of great imaginations. The lower you get down in the scale of life the poorer the imagination. While it is true we all possess these faculties to some extent, it is also true that every man can develop them to an extent marvelous in results. No man is so strong that he cannot become stronger in them. But the faculties that produce endurance and ability are not enough. Reliability is required, and that springs directly from the feeling part of the mind. Such things as faith, ambition, enthusiasm, love, loyalty, honesty, etc., are absolutely necessary requirements to the successful getter and builder of business. A man must have faith in himself, in his goods, in the house and in the prospective customer with whom he comes in contact. If he does not possess faith—a strong faith—in these things he is bound to show it regardless of what he does.

He must have enthusiasm. He must have ambition—the kind of ambition that makes a man determined to be the best man on the job. He must develop a sense of brotherly love, kindness, courtesy and cheerfulness which comes from one deeply interested in his work, who has faith in it and who loves to help people. The salesman who goes out of his way to render a service to his customer, even though a trifling one, is doing much toward establishing confidence. The man with a pleasant smile, with an agreeable manner, with a kindly disposition is a magnet that attracts.

Men must learn more of the commercial value of the quality of loyalty. This they will get through a true appreciation of their responsibility to the company and the customer and to the other employees of the company. But there is still something lacking. A man may be strong physically, may possess strong endurance, may be an able thinker; his feelings may be such that he is a reliable or dependable man, yet he may never amount to very much if he does not have action. The reason that men do not accomplish more is because they do not attempt more. Men do not attempt more largely because of a weak will power. The will is the highest power of the human mind—the power of choice and action. This, like every faculty of the mind and body, through conscious effort, and physical and mental exercise, can be trained to a remarkable degree.

When we realize that Burbank, in California, can make a pitless plum, a fadeless rose, a white blackberry, a thornless cactus; can make the potato vine raise a fruit on the vine, while it is also raising potatoes under the ground, and can make the pear tree get busy enough to raise two crops of pears a year, it is high time for us to realize that the personality—the force and the power of the human plant—the highest form of life on earth—can be trained to a marked degree.

This, then, outlines the secret of personality of the salesman. A man with a strong development along these lines possesses the "power to persuade plenty of people to purchase at a profit that which he has to sell." In addition to developing the personality of the salesman, by the cultivation of his positive forces, he needs must acquire a more accurate knowledge of the great book of human nature. Men are finding out that they cannot trust to the acquiring of this knowledge simply from their own observation, but a scientific study of the subject reveals the characteristics and traits of the individual in such a way that the salesman can operate more in harmony with the law of non-resistance.

An immense volume of business is lost on account of the antagonistic methods of the salesmen, due to the lack of knowledge of how to handle people. Some of the ablest men of the world have devoted much of their lifetime to the study of types, of temperaments and so forth, of men, so that through the expression, the voice, the language, poise, gesture and the like they are able to understand them and harmonize with them better.

The salesman must also be a logical thinker and a logical talker. Therefore, the study of logic, as applied to business, will reveal to him the methods for a complete analysis of that which he wishes to sell; so that from every viewpoint he will get at the selling points that will appeal to the mind of the customer. It will then reveal to him how to synthetically put these points together into a selling talk that will be attractive, agreeable and forceful. The lawyer carefully maps out his argument to the jury. If it is illogical it does not carry weight with the jury or the judge; and so the salesman must remember to carefully plan and logically present his selling talk, and he should also study the best forms of expression so that he will clearly convey his idea to the mind of the customer that he is endeavoring to interest.

Finally, the salesman should have a better knowledge of the laws governing the operation of the human mind. His value depends upon his ability to create the right kind of impression in the mind of the customer. In other words, he must be able to attract attention, arouse an interest, create a desire and bring about a decision. He must know how to do these things. He must know when he has done them and he must know what to do at the proper moment or he is in danger of not making any substantial headway at all or of talking the man into a sale and deliberately talking him out, without knowing it.

Sales managers have found it impossible to train men to any great extent along these lines, with the exception of assisting them to get at the points of merit of their proposition; but since these other factors enter into the transaction, and are of such importance, it is a matter of great moment to give them proper consideration. The business world has long needed a method by which the individual could study and develop himself along these lines. It is purely a matter of education. The basic method of education in the schools and universities and in connection with all other professions has been in the use of text books which the student could study, absorb and apply.

Heretofore business men have not had a literature along these lines. The great law of demand is the cause of the creation of an educational institution that has furnished a course of instruction which goes into these things in a thoroughly scientific way. The phenomenal success of the institution which, being only a little over 5 years old, now having about 30,000 students, 85 per cent. of whom are experienced business men, is an evidence of the need of work of this kind and the eagerness with which it is being applied.

As stated before, confidence is the basis of trade, but it does not all consist of the ability of the salesman to inspire confidence. The product that he sells must give satisfaction, and back of that the company itself must be managed by men of such personality that they will maintain the confidence that has been inspired through the salesman. Water cannot rise any higher than its source, and in many

cases the failure of the business getter can be traced to the head of the institution. They must realize the importance of the true spirit of co-operation with the business getter. They must realize the necessity of co-operating with him in educational matters, not only morally but financially, and then they must be ready to reward increased merit in the proper way. Those at the head of some companies have brought up objections to financial co operation with their employees along these lines.

One of these objections is that it costs money. Of course it does! We have to pay for anything that is worth while; still experience has shown that it is not an expense but in reality an investment which repays one hundred fold. Increase the power and ability of your men to get and build business and you are doing more to increase your assets and dividends than any other one thing that you can do.

Another objection might be that it is not the business of the employer to help educate the employee; that he should do it himself. Whether or not this is true, every employer knows he cannot depend upon the employee, except in rare instances, to take the initiative in matters of this kind. Is it, then, good business to lose the increased results which come from such co-operation, simply because it is thought that the individual should do it of his own accord and entirely at his own expense? Even though the argument might be advanced that the employee would receive an increased compensation from increased results, yet it is also true that the company will receive the larger share of the increased results. Therefore, it is a mutual matter in which the expense should be mutually met. Again, some think by educating the employee the company would lose him. Experience proves that the reasons why the majority of those who leave companies do so, are these: He has not received proper treatment from the company, or he has been a failure.

Most men who leave the employ of companies are those who are in reality not a success; who are dissatisfied, discontented and feel the lack of success within them. The successful man is too much interested in his work to take time to be considering other positions. Anything that will tend to increase his success means that much more of a hold on him by the company. Some might think that it would be looked upon as charity. It is not charity any more than any other method adopted for the betterment of the condition of the employee, which of course means the betterment of the company; and I have never known of a case where methods of financial co-operation along these lines have been viewed that way by the employee.

I do not deem it wise in matters of this kind where an expense is involved through taking up a course of instruction that the employer should stand all the expense; but it is a fact proven by much experience that it pays to share the expense with the employee. When this is done, they will enter into work of this kind in a body. It is taken up as an organization; whereas, otherwise, it might possibly be taken up only by an individual here and there.

Then, through meeting together and studying together along these lines, not only comes the greater development of the individual, but the development of the *esprit de corps* which is so very essential in the conduct of modern business. It is a wonderful treat to see employer and employees meeting together frequently, studying the development of themselves as men and of the highest and best principles and the application of them to the building up of the business on a firm foundation. In this way, through true education, will dawn the greatest age of peace and prosperity which will be unshaken by the winds that blow or the storms that rage.

The Latest Improved Coke Oven System and Coke Handling Devices of Dr. Theodor von Bauer.

By Mr. O. Simmersbach.[1]

In the latest design of coke ovens, the system of Theodor von Bauer, two longitudinal flues are provided on top of the combustion chambers between the coking chambers. These two flues are arranged immediately above each other. All the upper flues communicate with the lower flues of the same set by means of a series of openings and in a similar manner, also with the upper flues of the adjoining sets across the tops of the intervening coking chambers. The lateral flue connections also pass over the charging openings on top of the coking chambers. This flue arrangement assures not only a uniform distribution of the fuel gases into the vertical combustion chambers, but also in the case of "direct" operation a uniform composition of the same by mixing the crude gases from the coking chambers. These naturally vary in their composition, according to the more or less advanced state of the coking process in the various chambers of the battery in the upper flues before entering the lower distributing flues and from there to the combustion and heating chambers. In the case of "indirect" operation, the auxiliary fuel gas supply enters the upper and lower flues from the outside and is distributed in the lower flues into the combustion or heating chambers. The change from the "direct" operation of the coke oven to the "indirect" is accomplished by disconnecting the upper flue system from the charging opening on top of the coking chambers, and using the upper and lower flues for the reception, mixing and distribution of the fuel gases coming from the condenser or of auxiliary fuel gases from other sources into the combustion chambers. The design of the latest improved coke oven is shown in the accompanying illustrations Figs. 1 to 5.

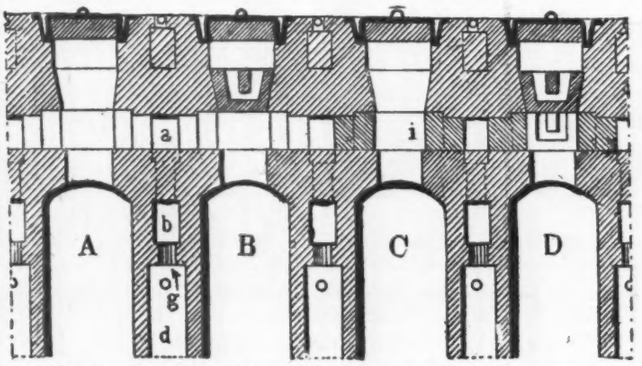


Fig 1.—The Different Methods of Operating the von Bauer Coke Oven.
A.—"Direct fire" oven with hand charging.
B.—The same with machine charging.
C.—"Indirect fire" or by-product oven with hand charging.
D.—The same with machine charging.

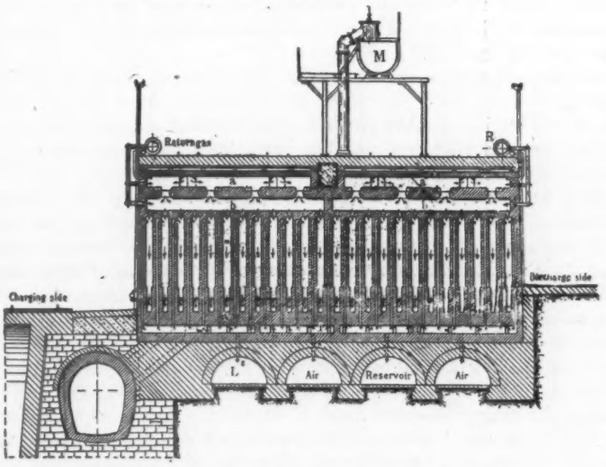


Fig. 2.—Section through the Combustion Chambers.

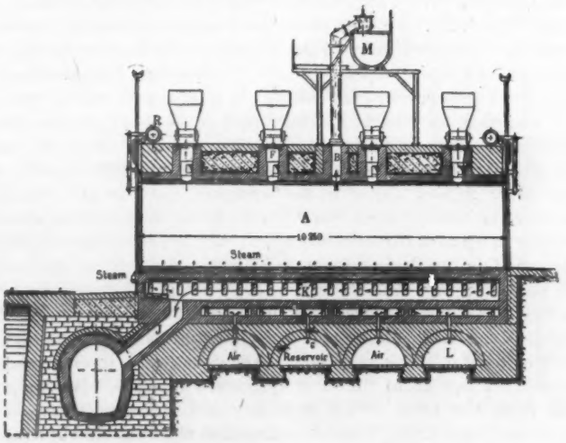


Fig. 3.—Section Through the Coking Chambers.

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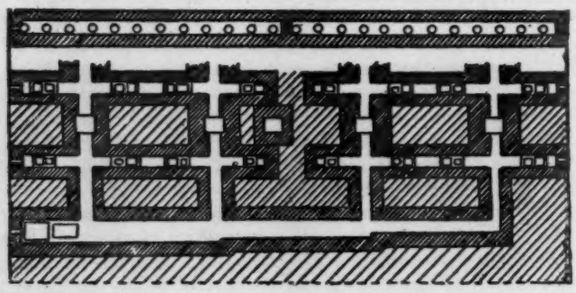


Fig. 4.—Horizontal Sections Through the Upper and Lower Distributing Flue System.

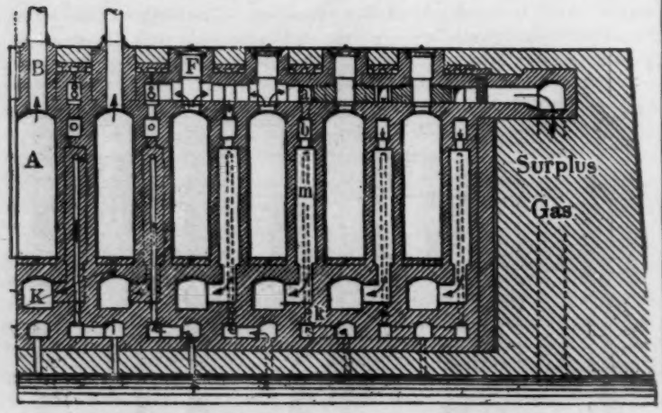


Fig. 5.—Cross-Sections: End of Battery with Waste Heat Flue.

Fig. 1 represents a vertical section through the upper part of a number of coking chambers, showing the method of operating a "direct fire" coke oven for "hand" charging *A*, a "direct" fire coke oven for "machine" charging *B*, as well as the method of operating a "by-product" coke oven for hand charging *C*, and for machine charging *D*.

Fig. 2 represents a vertical section through the combustion chambers.

Fig. 3 a similar section through a coking chamber of a coke oven.

Fig. 4 represents a horizontal section showing at a reduced scale the arrangement of the upper and lower flue systems.

Fig. 5 represents a vertical cross-section showing the end of a battery of coke ovens with flue for the removal of the surplus gases.

Above the walls, between the coking chambers, are located the mixing flues *a*, which are in connection with the charging chutes or shafts of the coking chambers and also with the adjoining mixing flues. Below the mixing flues *a*, and in the walls between the coking chambers, are located the distributing flues *b*, which communicate with the mixing flue above and with the combustion chambers or heating flues below; the latter being also arranged in the walls between the coking chambers.

By the "direct" operation of the coke oven and hand charging, it is only necessary to insert the covers for the charging openings in top of oven (Fig 1, *A*), while for "machine" charging the additional lower removal covers are inserted and made gas tight with a sand filling (Fig. 1, *B*). In both cases, however, the mixing flue system *a* remains in connection with the charging openings in the top of the coking chambers, as well as with the distributing flue systems *b*. The crude gases generated in the coking chambers, and which vary as to their composition, enter the mixing flue system *a*, where they are mixed so as to attain a more uniform composition. From this mixing flue system *a* the gases fall into the distributing flue system *b*, and from there finally through the openings *g*, into the combustion chambers or heating flues *d* in the walls between the coking chambers. In order to operate the coke ovens on the "indirect" system it is only necessary to close the connections between the mixing flue system *a* and the charging chutes or shafts by means of firebricks or form blocks *i*. In hand charging (Fig. 1, *C*) only one cover is used for the closing of the shaft, but by machine charging (Fig. 1, *D*) an additional cover with sand filling is used. In the coke ovens thus arranged for indirect fire operation the flue systems *a* and *b* receive the purified gases from the oven or an auxiliary fuel gas supply from another source for distribution into the combustion chambers in the same manner as the crude gases when operating the ovens direct. The auxiliary gas supply may be used exclusively, or for mixing with the purified gases from the coke ovens.

A small steam pipe discharging into the mixing flue *a* is used for blowing out from time to time any soot that may accumulate when operating the coke ovens direct. This avoids the necessity of cleaning these flues by hand, thus saving loss of time in cooling the flues, etc.

The superiority of this coke oven construction is manifested in the increased yield of coke, which is even greater than that obtained by the crucible test. Although it may appear peculiar, this assertion is borne out by the official annual reports of the Krupp colliery, "Hanover," for the time from January 1, 1903, to June 1, 1904, stating that the average yield of coke was 73.6 per cent. in the Dr. von Bauer coke ovens against 68.4 per cent. in an adjoining coke oven of one of the most extensively used systems, which latter results correspond to those obtained by the crucible test. This regularly obtained increase of more than 5 per cent. in the yield of coke over that obtained by the crucible test is mainly due to the conditions of temperature uniformly maintained in the von Bauer coke oven, which favor a partial decomposition of the heavy hydrocarbons and a subsequent deposition of a part of the carbon therefrom upon the coke, and to the arrangement and location of the flues for the preheating of the air supply for the combustion chamber, which preclude any possibility of air entering the coking chambers. These slight losses of heavy hydrocarbons in direct fire coke ovens are of minor importance, since these hydrocarbons will come into use only when utilized for illuminating purposes.

In by-product coke ovens these conditions differ in so far as after the charging of a coking chamber (Fig. 3, *A*) the generated gases rise through the standpipes *B*, into the gas main *M*, leading to the by-product plant for the extraction of tar, ammonia and benzol. The purified gases are returned through the main *R*, and, by means of special individual connections, introduced as fuel gas into the mixing and distributing flue systems *a* and *b*. The provision of a regulating device on these individual connections affords a much closer adjustment of the gas supply than it would be possible with a number of single tuyeres. The reason for this is that more or less of the gas supply will be properly distributed in the distributing flues before entering the combustion chambers. The uniform fuel supply thus obtained prevents all excessive variations in the temperatures, which on the one hand may result in cindering and melting of the walls, and on the other hand in dark or underheated places in the walls of the coking chambers. A uniform gas supply will naturally result in a correspondingly uniform supply of air for the combustion. From the flue systems *a* and *b* the gases enter the combustion chambers (Fig. 2, *m*), where they meet the highly preheated air. The gases of combustion are then drawn down and collected in the collecting flues *K*, located under the coking chambers (Figs. 3 and 5), and discharged through the connecting flue *J* into the main flue, to be either further used in boiler furnaces or finally discharged through a chimney.

The air for combustion is taken from the spaces under the ovens formed by the large foundation arches. These arches serve for the preliminary heating of the air supply as well as for the cooling of the oven foundations. This arrangement restricts the required openings in the sides of a battery of ovens ts those required for the charging and discharging of the coking chamber by machinery, and in the top to those required for admission of coal in the case of hand charging and for the necessary gas take-offs.

In case the ovens are charged with machinery, the charging openings on top are closed with suitable form blocks so as to avoid any admission of air into the ovens. These form blocks can be quickly removed in case of a mishap to a coal breaker or charging machine and the ovens charged by hand. The air for the combustion is supplied in four separate compartments formed by the large foundation arches, the air inlets to which are controlled with adjusting dampers. From these large air reservoirs the air enters through the openings *g* and *h* into the distributing ducts *i*, in which the air, being exposed to the heat from the gas flue *K*, is heated to about 1,100° F. From the distributing ducts *i*, the air rises through special uptakes moulded in the material forming the walls of the coking and combustion chambers, thereby extracting heat from these walls and increasing its own temperature to about 1,920° F., as has been proven by measurements with electric and optic pyrometers on various coke ovens of this system. This arrangement provides not only a simple and convenient means for preheating the air for combustion, but at the same time also for the extraction of excessive heat from vital parts in the ovens and thus checks any detrimental effects that would otherwise result. The fact that the highly preheated air is introduced through separate openings into each individual combustion chamber, assures the best

possible combustion. The preheating of the air in this way without generators or separate recuperators has proven a practical success, as the air is highly heated in a simple and economical manner and a greater yield of surplus gas obtained than from any other construction and design of coke oven. This assertion is corroborated by the results obtained at various large coke oven plants. Because of the highly preheated air the combustion is naturally complete and the resulting high temperature is produced in the combustion chamber at and below the surface line of the coal charge in the coking chamber. Furthermore, as the gases of combustion have a downward course, high temperatures and the resulting superheating of the upper parts of the coking chambers are prevented, and thus also any decomposition of the valuable gases in the coking chamber before their removal through the standpipe *B*, into the collecting main *M*. The design and detail construction of the coking chambers are such as to render them perfectly gas tight and so as to prevent the escape of any gases from the coking chambers into the combustion chambers. On account of the short travel of the gases of combustion a slight chimney draft is required so that there is no possibility for creating a vacuum in the coking chamber.

In coke ovens, with separate provision for the preheating of the air for combustion, it is impossible to avoid sudden changes in temperatures with a corresponding loss of heat, lower temperature and quality of the flue gases, etc., while in the improved von Bauer system of coke ovens the heat taken up by the air for the combustion is immediately utilized in the process of combustion.

The arrangement of the two flue systems, for the mixing and distribution of the gases, prevents not only the superheating of the upper part of the coking chamber, which would result in a decomposition of the generated gases, but also allows the admittance of air in the upper flue system in case a higher temperature of the upper parts of the coking chambers is desired. Likewise it is possible to use generator gases from other sources as fuel in case the coking coals do not yield a sufficient quantity of gas for fuel purposes, or the generated and purified gas is intended for more economical purposes, as for gas engines, etc. As stated before, in all cases the gases *move only in a downward direction, the preheated air only in an upward direction.*

The average coking period in the new coke ovens is from 24 to 26 hours, which corresponds to a yearly capacity of 180,000 to 190,000 tons of blast furnace coke for a battery of 100 ovens. At the same time the ovens yield from 45 to 50 per cent. surplus gas, according to the kind of coal used, while the flue gases, because of their short travel, have a higher temperature than those from other coke oven systems, where the flue gases have to pass extensive regenerators and checkerwork, which necessarily reduce their heating value. Furthermore, the omission of such complicated and costly devices for the preheating of the air for combustion *reduces the cost of construction* of these ovens considerably and at the same time *simplifies their installation and operation.* For new installations the required foundations are much simpler than for other systems; but, on the other hand, the new coke ovens can also be installed on existing old foundations of other coke oven systems. Numerous tests have demonstrated that in the regular operation of the new von Bauer coke ovens the transmission of heat from the walls of the coking chambers to the coal in the coking chamber is gradually reduced toward the end of the coking period and that the layer of coke nearest the heated wall and the gases generated in the chamber become hotter in the ratio as the coking process advances toward the center of the charge of coal; in fact, so much that during the last third of the coking period the heating of the coking chambers can be dispensed with entirely. In order to facilitate the completion of the coking process during this period, especially of the inner core of the coal charge, steam is admitted into the coking chamber through a special and patented device, for the purpose of more uniformly transmitting the heat from the walls of the coking chamber through the cracks and pores of the finished outer coke layer to the core of the coking coal charge. Actual experience has proven that with this arrangement *the coking period of the new ovens is shorter and the coking process more uniform* than without the same. Another advantage of this arrangement is that it *increases the yield of the surplus gas* considerably, and that, because of the lower temperature of the gases generated during that period, less washing and condensation surfaces are required. The starting and operation of this device are simply and conveniently accomplished by means of valves.

Prof. Kassner, of Muenster, Germany, claims he has proven that, with the above described device applied to the von Bauer by-product coke ovens, *the yield of gas, tar and ammonia is materially increased.* The von Bauer coke oven has the further advantage that it requires only four air inlets controlled with dampers located at the end of the battery, which can be *conveniently adjusted from the working platform,* instead of the many tuyeres (12 to 30 in each wall) as required by other systems. It contains *no heat flues in the foundations* which are difficult to control or inaccessible for cleaning. The distribution of the fuel gas into the combustion chambers, etc., is conveniently observed and controlled.

The lifting and lowering of the doors of the von Bauer coke ovens are accomplished through a patented hoisting apparatus. With this apparatus all doors of one battery can be operated from one place, since it is only necessary to attach a chain to any door and operate the controlling valve of the hoisting apparatus, which can be done by unskilled labor. The hoisting or the lowering of a coke oven door requires not more than from 3 to 5 seconds and is accomplished without the operator being exposed to the annoying heat, smoke and steam from the coke, while with most of the usual methods of operating, the doors remain open so long as to cause a detrimental cooling off of the chamber walls, and even the hot walls of the chamber ends suffer from the effects of their exposure to the sprays of the quenching water. This hoisting device not only saves the services of a man in each shift, but assures also a quick and easy opening and closing of the oven doors, whereby excessive heat losses are avoided and the quality of the coke near the doors considerably improved.

Fig. 6 shows the general arrangement of the apparatus for the hoisting and lowering of the coke oven doors. The buckstays of the oven settings are extended a certain distance above the top of the setting and there connected to each other by a continuous girder of steel channels. Over each oven door is placed a small idler for the lifting chain or cable on the same shaft with a larger roller. The latter rollers support a rod provided with suitable eyes or hooks to receive the corresponding hook or eye on the end of the hoisting chain for each door. At one end the rod is coupled in a suitable manner to the piston rod of a working cylinder which may be operated either by steam, water or compressed air.

An electrically operated device for loading coke direct from the coke ovens into railroad cars has proven to be of great advantage. The device consists of a traveling crane about 33 feet high, with cantilevers 30 feet long, and a hoisting trolley with 4 hoisting cables or chains. Near the base of the 4 columns of the crane frame is arranged a bin for the coke ashes. The coke from the coke ovens is taken up in coke pans constructed of steel and arranged on wheels so that they can be placed in front of any of the ovens in the battery. The upper half of these coke pans is arranged as a grate of sufficient length and width to allow for the charge of one coke oven to be conveniently spread out and quenched. The grate is constructed of flat iron on edge with spaces ⅜ inch to ½ inch in the clear. Usually a coke pan of this character is about 30 feet long by 8 feet wide in the clear.

The method of operating this device is the following:

As soon as one coking chamber is to be discharged the coke pan is placed in front of the oven and the discharging machine pushes the finished coke upon the pan and 2 men immediately spread and quench the coke. In order to allow the coke to cool the finished coke from another oven is pushed upon a second pan. In case the coke upon the first pan is sufficiently cool for loading, the hoisting trolley elevates the coke pan to a height of about 15 feet and conveys it over an empty car. In this position the hoisting mechanism of the trolley tilts the pan in an inclined position, which causes the coke to discharge and the coke ashes to pass through the grating into the bottom of the coke pan. The hoisting trolley with the pan in the inclined position is then run over the ash reservoir and the accumulated ashes deposited in the ash reservoir by opening a damper at the head of the ash box. The empty coke pan is then lowered and placed upon the track in front of the ovens ready for the next filling. In the meantime the coke in the second coke pan is sufficiently cooled for loading. The coke ashes accumulating in the ash reservoir are removed from time to time as required.

The time required for loading the coke from one oven, attaching the cables of the hoisting trolley to the coke pan, lifting, running the hoisting trolley to the position for loading the railroad car, unloading the coke and ashes from the coke pan, returning and lowering of the coke pan upon the tracks in front of the coke ovens, is about 10 minutes.

The required labor in connection with the quenching and loading of the coke from 40 to 50 ovens can be easily accomplished by 3 men in 10 hours, which would correspond to a capacity of the traveling

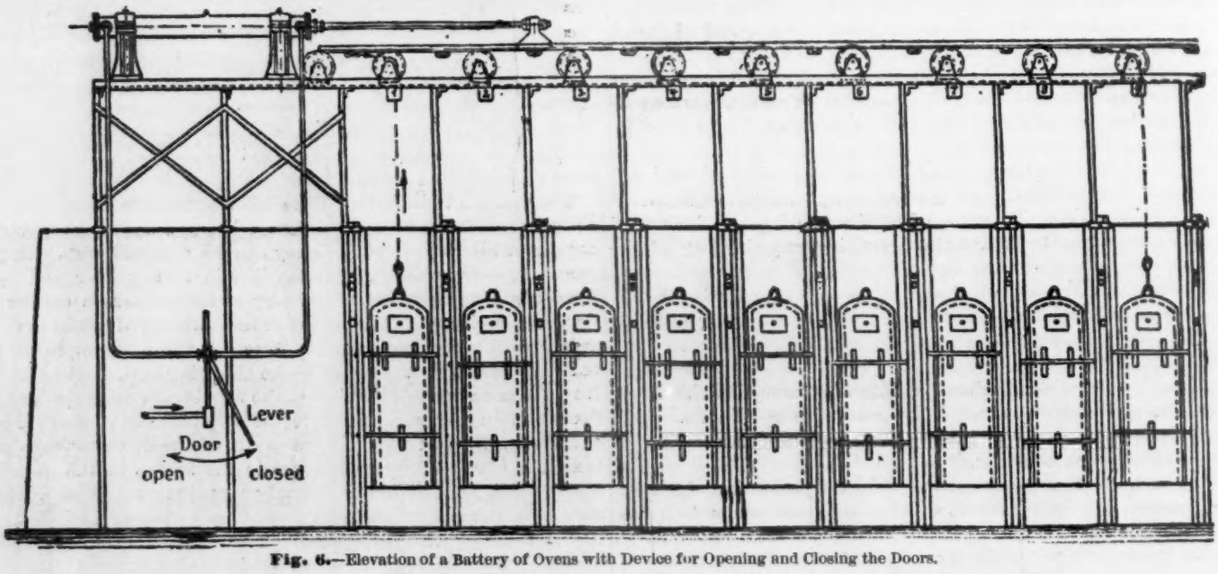


Fig. 6.—Elevation of a Battery of Ovens with Device for Opening and Closing the Doors.

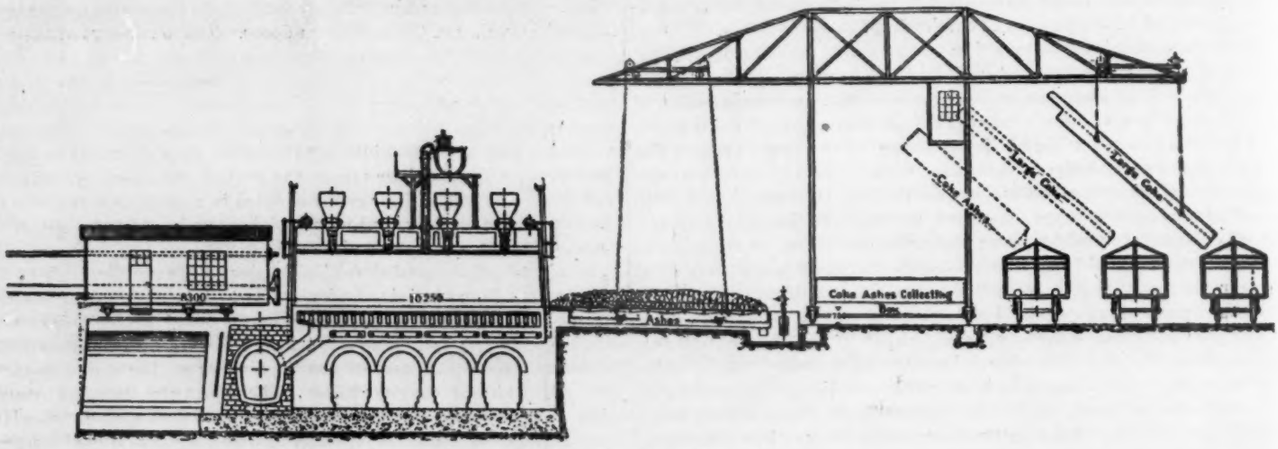


Fig. 7.—Traveling Coke Handling Device.

crane of 80 to 100 ovens in 24 hours. Besides the quick handling of the coke, another great advantage of this method of loading the coke is that all the usual intermediate handling, which causes a considerable breaking up of the coke, is avoided, and the coke can be shipped in larger pieces.

The method of handling the coke from coke oven to railroad car, for which purpose the necessary labor can be only 3 men, means a considerable saving in the operating expenses. A further advantage of the improved von Bauer coke ovens is that the coke storage and shipping floor can be arranged on a level with the discharging and quenching floor, which reduces considerably the height of the foundations.

Since the publication of the foregoing article Dr. von Bauer has made other important improvements in connection with the regulation of the fuel gas supply to the distributing flues in the upper part of the oven by omitting the internal adjusting tiles and substituting the same by independent direct gas supply to different parts of the flue controlled by valves, all located immediately opposite the upper parts of the partition walls, easily accessible on both sides of the ovens, and action seen through peepholes. Where it is necessary to widen the ovens toward the discharge end to provide for the expansion of the coal, the extra heat necessary for the larger body of coal in the wider part of the oven, can be easily supplied by proper control of the gas conduits supplying gas to the combustion chambers. The matter of preheating the air for combustion has also been improved in this last construction, by lengthening the ducts under the main combustion flue of the ovens. This arrangement is explained in Fig. 8.

The characteristic differences of the von Bauer system of ovens as explained in the description by Mr. O. Simmersbach in comparison with some other well known types of ovens, such as the Dr. Otto and Koppers systems of ovens, are clearly shown in Figs. 8, 9 and 10.

The principal advantages are as follows:

1. Inconvenience of access to tuyeres and the regulation of same in hot ducts is avoided by placing all controlling valves of the fuel gas supply on the outside of the ovens in a convenient location above the floor line, resulting in an intelligent control and observation on account of accessible location.

2. There can be no deterioration in the lower part of the oven, as all gas distributing flues in this part of the oven are omitted, and therefore the temperature is reduced to a minimum.

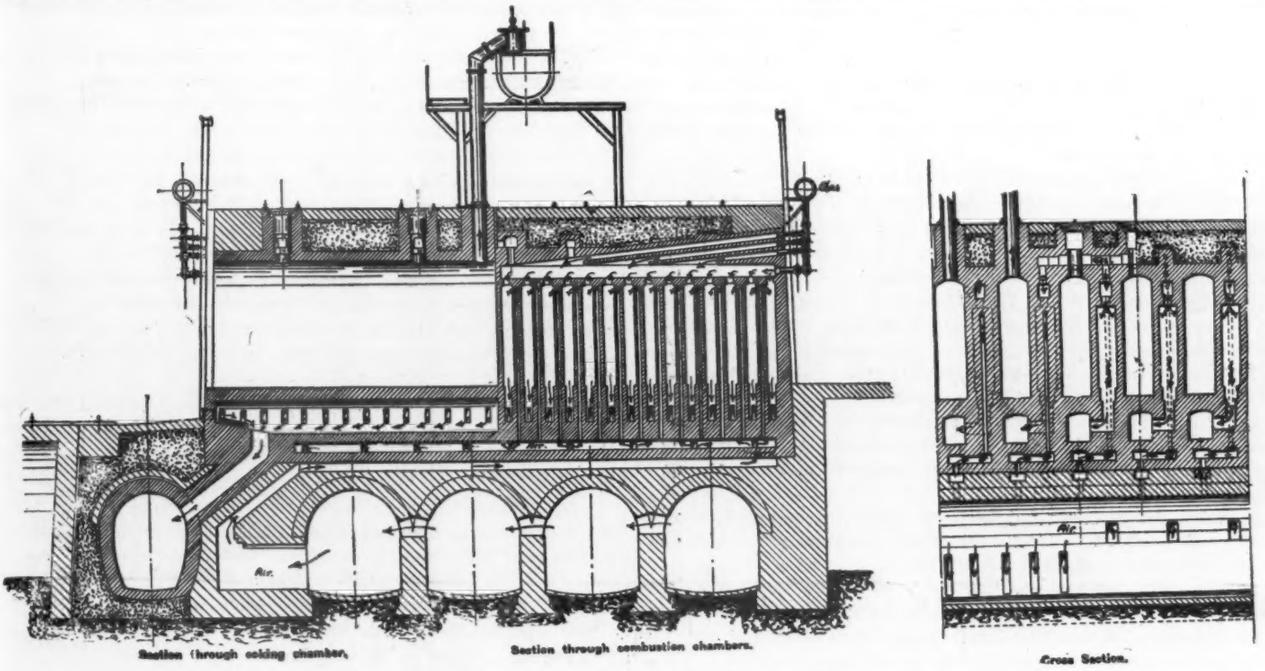
3. The details of construction of the partition walls of the coking chambers are of the strongest possible kind, as they are tied in a transverse direction by partitions extending from top to bottom, therefore all structural weakness caused by longitudinal combustion flues is eliminated.

4. Overheating of the upper part of the coking chambers is impossible on account of the continuous downward current of the products of combustion simultaneously in all flues. The point of entrance of the preheated air into the combustion chambers is at such low level that the upper part of the oven walls is maintained at a temperature which will prevent decomposition of the generated gases, and, therefore, provide for the highest possible yield of by-products.

5. The yield of surplus gas is materially increased on account of the rational heating of the oven walls in a downward direction simultaneously in all combustion flues, particularly as these conditions are maintained throughout the entire period of carbonization and are never reversed or changed.

6. Entire regulatiou of fuel gas supply is governed by a few valves on the outside of the oven in accessible location, thus reducing time and energy, required for regulation, to a minimum, resulting in the prevention of tuyere stoppages by naphthaline.

7. As all internal dampers and flue slides have been omitted in the newest construction of oven, as indicated in Figs. 8, 9 and 10, all an-



Figs. 8, 9 and 10.—Coke Oven System of Dr. von Bauer.

noyance resulting from the melting or destruction of interior adjusting tiles has been eliminated.

8. The top of the ovens setting is constructed in a perfectly solid manner as all openings through the same have been carefully avoided. thus excluding all possibility of water entering the upper portion of the masonry, preventing all possibility of evaporation, formation of steam, etc., thus eliminating all danger of destruction from this source.

9. Absolute uniformity of heating the entire oven wall, for the reason that all irregular heating is excluded, as conditions governing the heating of the walls are never changed.

10. All complicated foundations are avoided as well as expensive regenerators, thus the construction of foundations is not only simplified but its cost is materially reduced.

11. A large amount of surplus heat is available for steam boilers and other purposes for the reason that the preheating of air required for combustion in large regenerators is entirely avoided.

12. Simplicity in the method of preheating the air required for combustion to a high degree in a most effective manner by the introduction of small vertical flues located between the combustion flues in the walls of the oven chambers.

13. The von Bauer ovens can be converted from a "direct fire" to an "indirect fire" operating system and vice versa in a minimum of time without any interruption in the operation of the ovens and without effecting the quantitative or qualitative producing capacity of same. In one instance such complete change from one system to another for a battery of 60 ovens was accomplished inside of 8 hours.

Smoke Abatement.

"Bulletin No. 334" of the Department of the Interior, which has to do with "The Burning of Coal without Smoke in Boiler Plants," is a preliminary report on the matter, prepared under the direction of Mr. D. T. Randall. That gentleman is to be congratulated over the clearness of his presentation of the subject, and every fuel user in manufacturing operations should possess himself of a copy of the document. We take the liberty of reproducing its two concluding chapters:

Indirect Methods of Smoke Abatement.—There is at present a general tendency to centralize power, heating and gas plants. In the heating of buildings it is customary under existing conditions to generate steam in the building. Where this is done, it is in general considered more economical to install engines for generating current for light and power also. However, many buildings furnish their own heat, but purchase current. Large power or light plants can now be located at any convenient place, say at the coal mines, because of the ease and economy with which electric current can be transmitted; but heating plants, whether for residence or for business districts, must be within a comparatively short distance from the section to be heated on account of the cost of installation and the losses from radiation. There are now more than 150 central heating plants in the United States, furnishing steam or hot water to residences or business buildings or to both. The greater number of these plants are located in the coal-producing States. Some of them have been built especially for the purpose of heating; others are additions to electric lighting or industrial plants and utilize the exhaust steam from the engines. These central plants can be operated without smoke under favorable conditions, and they relieve the smoke situation in a measure. The plan of purchasing both heat and light, not only for residences, but also for business houses, is popular because it relieves the consumer of the details of operating a plant, does away with the dust of coal and ashes, and makes available for storage purposes space which would otherwise be occupied by the plant.

It has been suggested that in certain types of furnaces in which perfect combustion cannot be maintained the resulting smoke may be washed from the chimney gases in the same way as dust and soot are now removed from the air that is used in ventilating large office buildings, schoolhouses and hospitals.

The increasing use of storage batteries by street railways and other interests has aided in the prevention of smoke. These batteries furnish the extra power needed when traffic is heavy during rush hours on the street railways and make unnecessary any sudden heavy demands on the power plants. The load on the engines being more nearly uniform, there is less change in the rate of combustion in the furnaces and less smoke, for change of load and crowding of boilers constitute a most prolific source of smoke.

Summary.—The increasing use of gas and coke for domestic, manufacturing and power purposes and the centralization of power and heating plants tend to relieve cities of a large percentage of the smoke now given off by small and inefficient heating and power plants. Notwithstanding the fact that other ways of utilizing coal are growing in favor, it will evidently be necessary to burn coal in small boiler plants for some time to come. These coal burning plants will continue to keep the problem of smoke abatement before the residents of large cities.

It is recommended that in order to improve the conditions in any city a record of all equipment and furnaces in the power plants be made, and that improvements, methods of operation and the kinds of coal used be made a special study. It is only by such systematic methods that the local problem can be solved, as conditions in any one city are generally different from those in others, depending on the amount and kind of manufacturing and the character of the coal available.

The personal element is the most difficult obstacle to overcome in the fight against smoke. Study of the requirements and a desire to obtain good results on the part of the firemen will do more to clear the air in cities than any other one influence.

Being principally the result of an imperfect air supply, smoke can be prevented by providing for sufficient air and for its mixture with the gases in the furnace.

Well designed furnaces may smoke to a greater or less degree, depending on the methods of the firemen, the kind or size of the coal and the rate at which the coal is burned. They may be expected to give smokeless combustion when burning a suitable coal, except under the following unfavorable operating conditions:

1. When fires are built. The furnace not being heated to the required temperature, the gases cool below their ignition point and escape unburned.

2. When so much coal is burned on the grate that it is impossible to supply sufficient air without frequent poking. This condition usually results in so large a volume of gas from the coal that it cannot be properly mixed with air and burned in the combustion chamber. On reaching the boiler surfaces it is cooled, combustion is arrested and soot and smoke result.

3. When the rate of combustion is suddenly increased, as when more coal is added, and fires are poked to get up pressure in short time.

4. When the fires are checked by closing doors or dampers, thus cutting off the air supply. Banked fires are difficult to maintain and start up without smoke. Automatic dampers are frequently the cause of smoke when not properly adjusted or designed.

There is need of further study of coals, furnaces and combustion, but enough is now known to enable an engineer to design and operate a steam plant without objectionable smoke.

Adjusting Electric Light and Power Rates at Minneapolis.

The last week in February the Minneapolis General Electric Company and the Committee of the Minneapolis City Council came to an agreement on electric light and power rates, which likely means the early drafting and acceptance of an ordinance giving the Company a 30-years' franchise and fixing the rates for electric light and power for the first year of the franchise. The matter, which has been in controversy over a year, has brought out interesting points and helped to establish valuable precedents.

The City Council first passed an ordinance requiring a uniform rate of 8 cents per kw-hour, with discounts purely according to quantity. The Company refused to recognize this ordinance on the ground that it was unjust, inequitable and confiscatory. It offered instead, as it had in the past, rates based on the number of hours' use per month of the connected load. The rates now agreed upon by the Company and Council Committee are based on the sound principles of rate making for which the Company has contended, although the Company yielded to the Committee's idea on some points. The point of notable interest to electric light companies in this controversy is that a Company has been able to convince a Council Committee and citizens of the fairness of a rate based on load factor, and of the unfairness of a uniform rate per kw-hour for all classes of business. This was done largely by expert testimony and investigation.

The accepted residence lighting rate is 9 cents per kw.-hour for the first 52 hours' use per month, of 40 per cent. of the connected load and 6.66 cents for all over that. Commercial lighting is at the same rate, except that the maximum demand as measured by maximum demand meters is substituted for 40 per cent. of the connected load. Minimum bills are $1 per month per lighting customer. Retail power is to pay 7.5 cents per kw-hour for the first 52 hours' per month of the customer's maximum demand, and 2.5 cents for all over that. The minimum bill is $1 per month per horse power connected. The chief difference between these and the old rates of the Company is that the maximum rate has been reduced on lighting from 12.6 cents for 52 hours' use of 60 per cent. of the connected lamps to 9 cents for 40 per cent.: and the minimum bill on power reduced from $2 to $1 per horse power. Free incandescent lamp renewals and free arc lamp maintenance have been abolished under the new rates. Quantity discounts from 5 to 25 per cent. are to be allowed on sums from $50 to $250 per month.

It was agreed by the experts that the maximum rates are below the profitable point as regards many small customers, and they were accepted as the equivalent of a franchise tax levied on the Company in the interests of small consumers.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. E. E. Eysenbach has resigned the position of General Manager of the Binghamton (N. Y.) Gas Works, in order to take up the duties of General Manager of the plants of the Consolidated Gas Company, of New Jersey. His headquarters are at Long Branch, N. J.

Mr. Eysenbach's successor at Binghamton is Mr. Charles W. Bennett, who was in charge of the Asbury Park division of the Consolidated Gas Company, of New Jersey.

The Kerr Murray Manufacturing Company, of Fort Wayne, Ind., has been awarded the contract for the construction of a 2-million cubic foot gasholder by the Washington (D. C.) Gas Light Company. It is to be of the 3-lift order and is to rest in a concrete tank.

Messrs. Bartlett, Hayward & Co., of Baltimore, Md., have been awarded the contract for the new purifying house to be erected in the Everett plant of the Boston Consolidated Company.

"The speaker of the evening at the recently held annual banquet of the Canton (O.) Board of Trade was Mr. Henry L. Doherty. His subject was 'The Building of a City,' and the 'Columbus man' certainly held the attention of his hearers.—F. M."

The annual meeting of the Utica (N. Y.) Gas and Electric Company is called for mid-day of the 6th prox.

At 3 P.M. of the 31st inst. bids for the public lighting of Wilmington, Del., will be opened by Secretary L. V. Christy, of the Street and Sewer Department. The contract is to run for 5 years, from Sept. 30 next, and the specifications call for the following: Incandescent gas lights, not less than 600; arc electric lights, not less than 350—each of an illuminating capacity rated at 9.6 amperes and 47 volts; incandescent electric lamps—each to rate not less than 32-candle power, or like lighting equivalents.

For pious gall this plaintive wail will likely be awarded a prize by those who are up to judging such matters. The "wailer" availed himself of the columns of a recent issue of the Albany (N. Y.) *Telegram*, although the matter discussed concerned the neighboring city of Troy. The matter is: "There is one effectual way in which the clergymen can close the saloons quietly and without any unpleasantness, put every saloon in darkness within 24 hours, and the plan is well worth considering if the church people are sincere. Down on the north side of State street, between Third and Second streets, is the office of the Troy Gas Company. Let the clergymen send a committee to the Gas Company and ask the officers and directors to stop selling light to the saloonkeepers. This would wipe out the saloons. The officers and directors and many of the employees of the Gas Company are members of the very churches, where worthy pastors are now demanding the closing up of saloons. Let the worthy pastors get busy and convert their own church members to this crusade. Let the pastors get busy by using their persuasive powers on their own members who run the Gas Company. Shut off the lights and the saloons would have to close. But maybe the clergymen want more strenuous politics to intervene." Like all great discoverers this Troy yawper seems to forget that there are other lighting agents than gas and electric currents. Such things, for instance, as kerosene oil, candles, pine knots, and the like. So it would appear that ere this glorious crusade on the Troy Gas and Electric Company could be made truly effective, the Rockefeller Brothers, Mr. Rogers and their confreres, should be invoked; also the tallow chandlers, and then to the woods!

The plant of the Citizens Gas Company, of Burlington, Wis., is now in active operation.

The Mobile (Ala.) Gas Company's plant is to be enlarged this spring. One of the contracts in connection with this construction, which has been awarded to the Gas Bench Construction Company, of St. Louis, calls for the erection of 6 benches of full-depth inclined sixes, complete, with Faben patent tar apparatus.

The Cruse-Kemper Company informs us that its home address hereafter is at Ambler, Pa., thus bringing its offices and shops together. Ambler is close by Philadelphia, on the line of the Philadelphia and

R ading Railroad, and the train service thereto and therefrom is of the frequent sort. The Company's branches in Chicago and in Seattle, Wash., will be maintained as usual. Mr. Cruse and his associates extend their greetings to the fraternity and will be glad to show them through a well equipped, up-to-date series of shops.

IN line with the Troy, N. Y., parties may be placed the "Reverend G. R. Robbins," who has been conducting in Cincinnati a series of sermons the main telling of which was "Praying for the Rich and the Gas Company." Those holier than thou ranters should be estopped from publicly defaming public companies, the doings of which are certainly looked after zealously by the law makers and law enforcers; for any ranter, especially if garbed in the raiment of the clergyman, and practicing as such, can undoubtedly sway the minds of those not of the deep thinking order.

A FEW evenings ago Mr. L. B. Lent read a paper before the Engineers Club, Brooklyn, N, Y., on "The Gas Engine in the Power House," before a large audience whose interest in the proceedings was well shown in the general discussion that followed the reading on the merits of gas engines in industrial pursuits. The lecture was illustrated by means of 60 lantern slides.

THE Public Buildings Committee of the Deering District (Portland, Me.) City Councils, after a lengthy investigation, have condemned the gas plant in the Deering High School which was used to furnish gas for the experiments that were conducted in the laboratories of the chemical section. The plant was of the gasoline type.

THE Suburban Gas Company, of Chester, Pa., is arranging to make important main extensions to its system this spring, particularly in the district traversed by 24th street, Edgmont avenue and Madison street. The Company's business grows rapidly.

THE Morton Iron Works, which has been conducted by Mr. Charles L. Rowland, in the Greenpoint section of Brooklyn, N. Y., for many years, has amalgamated its business with that of the American Welding Company, the shops of which are located in Carbondale, Pa.

"GENERAL MANAGER HENRY B. HOYT, of the Jacksonville (Fla.) Gas Company, reports good business since January 1st. He believes in the good value of demonstrations, for a demonstratress is on duty in the handsome offices on Forsythe street, West, every afternoon between the hours of 2:30 and 5. Her model kitchen is verily the show place of the town, a part of which popularity is no doubt traceable to the fact that a dainty luncheon is served to each lady visitor while the demonstratress is demonstrating.—V. T. R."

THE sale at auction of the properties and franchises of the Connellsville and New Haven (Pa.) Gas and Water Company, which was to have been brought off in Connellsville the morning of the 29th ult., was postponed for a period of 60 days.

THE growth of the business of the Manitowoc (Wis.) Gas Company has been so pronounced that its proprieters are already arranging for marked extensions to the plant. The spread of gas for cooking purposes is the reason for this enlarging.

THE changes in the management of the Cleveland (O.) Gas Light and Coke Company may be thus summarized: President, C. H. Beardslee; Vice-President, C. E. Gowan; Secretary, W. K. Sladden; General Superintendent, Chas. S. Beardslee; Manager commercial division, Carlos E. Moore.

THE gas and electric lighting plants which formerly served the residents of Clyde, N. Y., has been dismantled.

MR. EDWARD HOFFMAN, formerly in charge of the engineering division of the South Bend (Ind.) Company, has been appointed Superintendent of the Syracuse (N. Y.) Lighting Company.

BILL No. 73 in the New Jersey Senate provides that the authorities of South Orange, N. J., may either acquire by purchase or construction, a gas and electric lighting plant for operation on municipal account.

THE agreement reached by the city officials of Fort Wayne, Ind., respecting the rates at which the Fort Wayne Gas Company may transmit and sell artificial gas to the residents instead of natural gas is now being considered by the Company. We are told that the same are acceptable to Mr. Henry C. Paul, the Receiver of the Company, and that there is every likelihood that the same will be accepted. We here repeat the schedule: During 1909 and 1910, net, 90 cents per 1,000; thereafter, 85 cents per 1,000.

MR. HENRY T. HUGHES has been appointed Auditor of the Denver (Col.) Gas and Electric Company. His record with the Company is that of continued promotion, he having entered its service as lamp man in 1894.

THE conflict of words between the Hartford City (Conn.) Gas Light Company and the local electric light company, as to whether each shall invade the other's territory, is still on. President Dunham, of the electric lighting forces, rather thinks that the Gas Company's people might find it somewhat difficult to raise the capital necessary to get actively in competition on electrical current account.

ADVICES from Boston, Mass., under date of Monday last, are to the effect that the entire bench of the Massachusetts Supreme Court, in a decision handed down the last week in February, in the case of the Edison Electric Illuminating Company and the Brookline Gas Company, for the division of newly developed territory, so as to avoid duplication of services was valid. The case centered around the home of Mr. Charles G. Weld, of 45 Bay State road. The Edison Company supplied him with electrical currents until 1902, when, after agreement with the Edison Company, the Brookline Company purchased that Company's wires and conduits west of Deerfield street in the Back Bay. The Court holds that the policy of the State is to regulate and control gas and electric light companies against evil effects of monopoly, rather than by competitive action by two or more Companies, when such competition will greatly increase the cost of supplying the needs of the public. The State has taken complete control of such Companies through the Board of Gas and Electric Light Commissioners, so far as is neccessary to prevent abuses of monopoly. As the arrangement between the two Companies relates to a newly developed territory and does not injure the plaintiff it is held that it is a mere detail of administration and dismisses Weld's proceedings.

THE proprietors of the Willimantic (Conn.) Gas and Electric Light Company have announced that on and after April 1st the rates will be on all account and use $1.50 per 1,000 cubic feet net, or $1.60 gross. At the present time the rates are, net: On illuminating account, $1.75 per 1,000; on fuel account, $1.25.

S. PANCOAST LEWIS, of Lansdowne, Pa., has gotten up a clever little story the title of which is: "Jimmie's Little Experiment," the text of which narrates how "Jimmie" succeeded in getting his brother-in-law to purchase and install in the kitchen of his home a gas range. Author Lewis had the benefit of the pencilling of artist H. H. Knerr. Send to Lewis for a copy of it.

MR. F. E. REIDHEAD, who has managed the gas and electric properties of Messrs. Stone & Webster in Columbus, Ga., since 1905, has been appointed General Manager of their properties in Paducah, Ky. Prior to his assuming charge at Columbus, Mr. Reidhead was General Superintendent of the Minneapolis (Minn.) General Electric Company's division.

THE Bristol Company, through its Chicago offices in the Monadnock Building, informs us that it has decided to publish each month a sort of house organ as a means of keeping it in close touch with its many customers, so that they can become familiar with the new lines, types and ranges of instruments that it is sending out. The Company wishes to have as many readers of this "organ" as possible, and with that end in view asks any gas man who would like to look it over regularly to send in his name and address. The distribution, or course, is to be without charge.

IN the contention between the authorities and the Galesburg (Ills.) Gas Company relative to which was the life of the Company's franchise, the Circuit Court has decided that the life thereof was unlimited.

THE City Council of Port Huron, Mich., has virtually decided to hold a special election on the 6th prox., to determine whether or not the city shall engage in the operation of a gas plant. No matter how the votes are cast, the debt limit of the city having been reached, if not exceeded, the vote would only have significance as a mere expression of the voters' preference.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 42 Pine Street, New York.
Telephone, 2996 John.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance, Single copies, 10 cents.

The JOURNAL is the official organ of the NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Company, 39 and 41 Chambers street.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime street, London.

MONDAY, MARCH 9, 1908.

The Market for Gas Securities.

Consolidated gas shared in the depression that ruled the market early in the week. Today (Friday) the opening bid price was 97⅞ to 98. Brooklyn Union was dull and little inquired for. The difference between buyers and sellers is only 10 points—88 to 98.

In the outside market, Peoples, of Chicago, stands as it did a week ago. To a certainty we know where 1,200 shares were picked up for cash by one of the shrewdest investors in this city. The general situation in the industry is excellent.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

MARCH 9.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	97⅞	98
Central Union Gas Co.—				
1st 5's, due 1972, J. & J.	3,000,000	1,000	92	97
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	—	105
Mutual	3,500,000	100	—	170
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	85	90
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	—	98	104
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	90	98
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	100	105
Con. 5's, due 1945, J. & J.	1,500,000	—	97	101
Standard	5,000,000	100	70	100
Preferred	5,000,000	100	100	125
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	100	105
The Brooklyn Union	15,000,000	1,000	88	93
1st Con. 5's, due 1948, M. & N.	15,000,000	—	91½	92
Yonkers	299,550	500	130	—
Out-of-Town Companies.				
Bay State	50,000,000	50	1	1 1-16
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	65
" 1st Mtg. 5's	500,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
" " Bonds, 5's	5,250,000	1,000	63	66
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed Gold Bonds	7,000,000	1,000	104	106¼
Cincinnati Gas and Electric Co.	20,500,000	100	91	92
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	92	98
Columbus (O.) Gas Lt. & Heating Co.	1,682,750	100	87	88
Preferred	3,026,500	100	81	82
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	—	105
Mortgages, 6's	3,600,000	—	—	118
Chesapeake, 1st 6's	1,000,000	—	—	—
Equitable, 1st 6's	910,000	—	—	—
Consolidated, 1st 5's	1,490,000	—	—	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	—	—	100
Detroit City Gas Co.	6,000,000	50	—	50
" Prior Lien 5's	4,618,000	1,000	—	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	30	40
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Lt. Co., 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	—	100	105
" Bonds, 5's	10,000,000	—	101	102½
Indianapolis	2,000,000	—	60	70
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	10	82	—
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	—	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	97	97¼
Preferred	2,500,000	100	92¾	93
Bonds	10,000,000	1,000	104	104¼
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	60	60½
Massachusetts Gas Companies, of Boston	25,000,000	100	51¾	52
Preferred	25,000,000	100	83¼	83¾
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	56	58
Bonds, 6's	6,000,000	—	137	138
New Haven	2,000,000	25	200	—
Peoples Gas Lt. & Coke Co., Chicago	25,000,000	100	86	87
1st Mortgage	20,100,000	1,000	—	—
2d "	2,500,000	1,000	104	—
Rochester Gas & Elec. Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104½	105½
San Francisco, Cal.	15,500,000	—	—	—
St. Joseph Gas Co.—				
1st Mtg. 5's	751,000	1,000	92	—
St. Paul Gas Light Co.	1,500,000	100	41	47
1st Mortgages, 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	96¼	—
Syracuse, N. Y.	1,375,000	100	50	55
Bonds	2,047,000	1,000	102	—
Washington, D. C.	2,500,000	20	288	300
1st Mortgage, 6's	600,000	—	—	—
Western, Milwaukee	4,000,000	—	—	—
Wilmington, Del.	600,000	50	230	—

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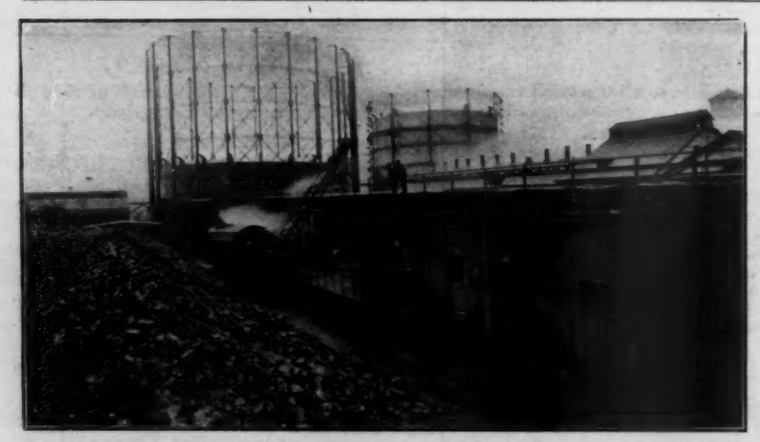

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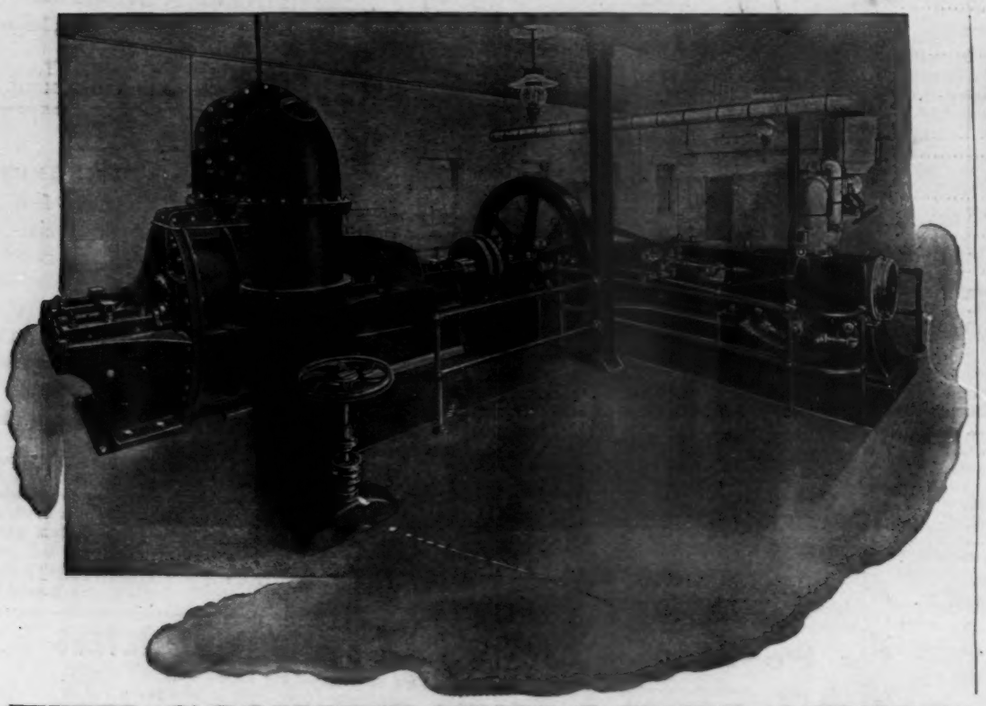

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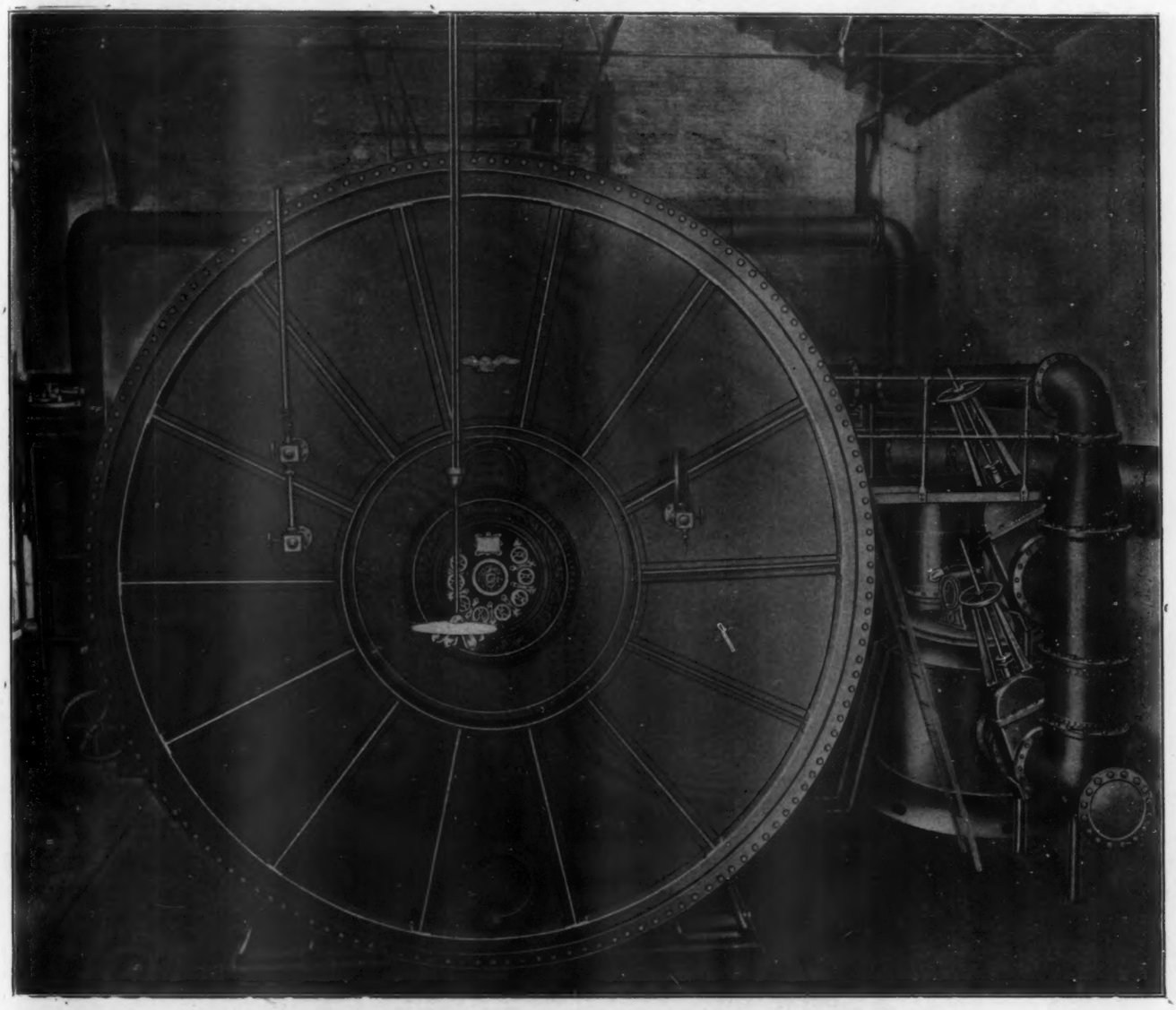

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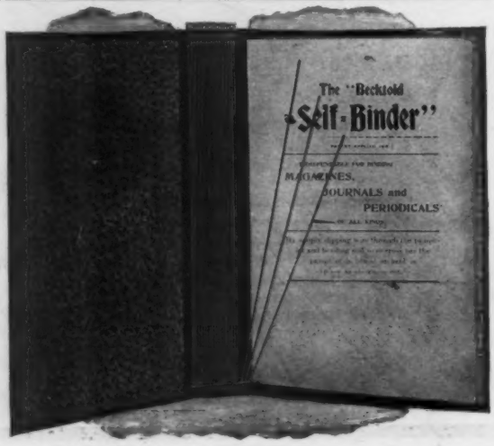

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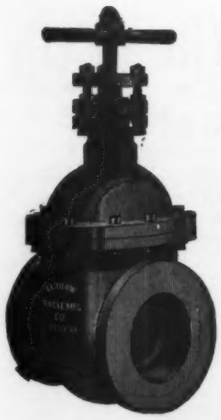

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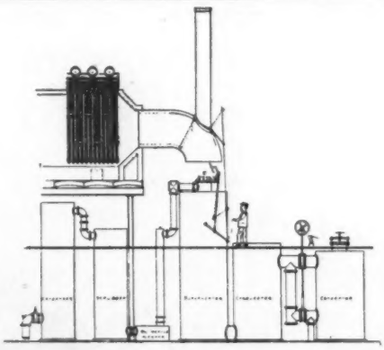

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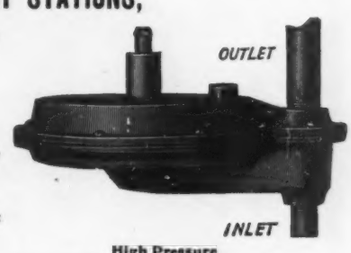

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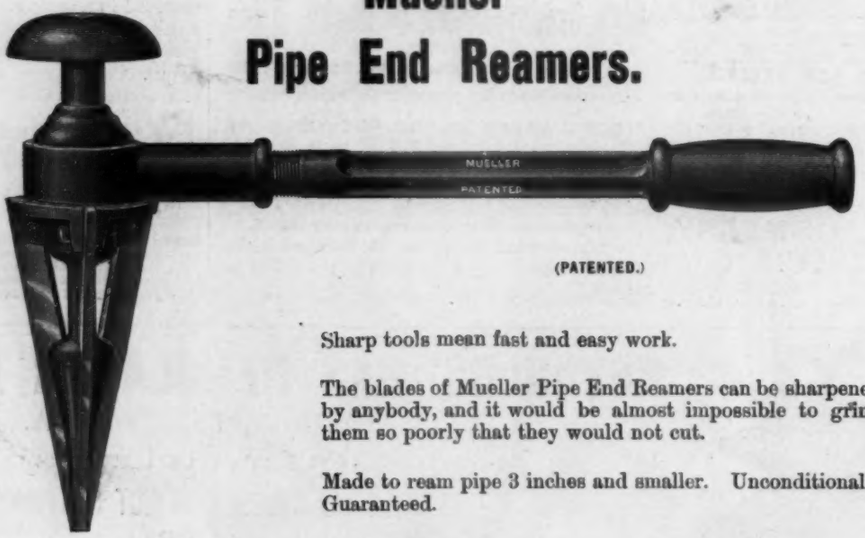

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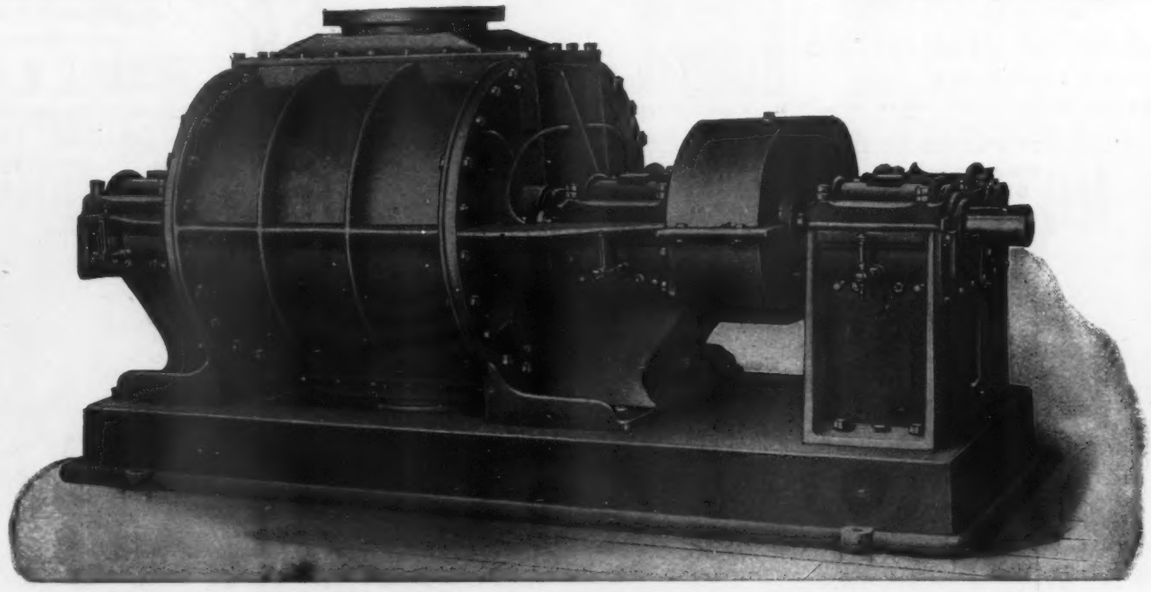

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PUBLIC LIGHTING TABLE.

MARCH, 1908.

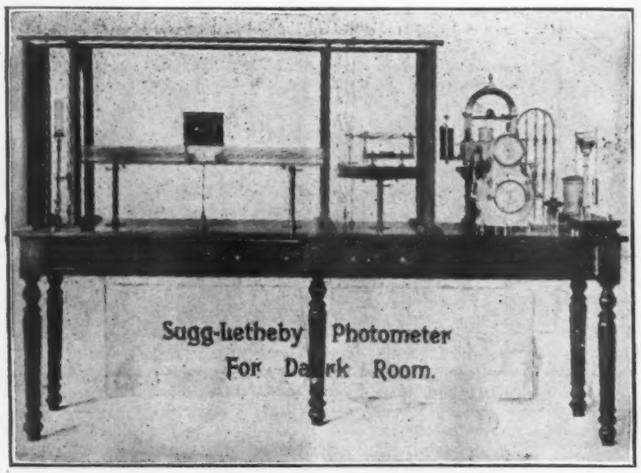
Table No. 1.
FOLLOWING THE MOON.

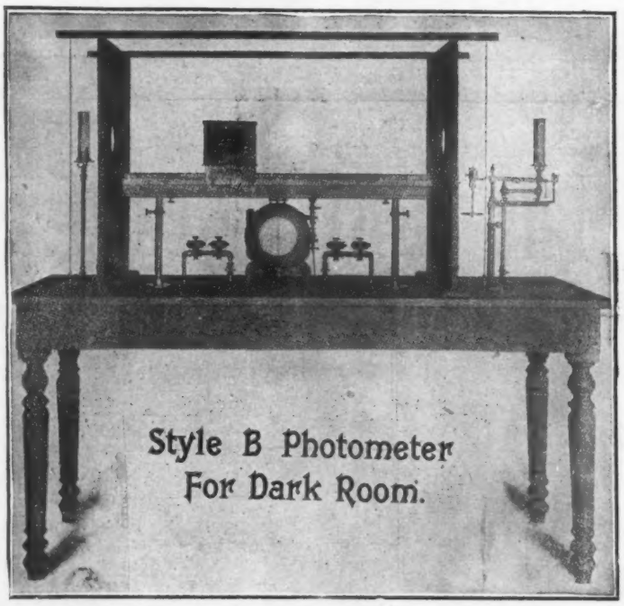
Day of Week.	Date.	Light.	Extinguish.
Sun.	1	6.20 PM	5.30 AM
Mon.	2	6.20 NM	5.30
Tue.	3	6.20	5.30
Wed.	4	6.20	5.30
Thu.	5	6.20	5.30
Fri.	6	6.20	5.30
Sat.	7	10.40	5.30
Sun.	8	11.40	5.20
Mon.	9	12.40 AM FQ	5.20
Tue.	10	1.30	5.20
Wed.	11	2.20	5.20
Thu.	12	3.10	5.20
Fri.	13	3.40	5.20
Sat.	14	4.20	5.20
Sun.	15	4.50	5.10
Mon.	16	No L.	No L.
Tue.	17	No L FM	No L.
Wed.	18	No L.	No L.
Thu.	19	6.40 PM	8.50 PM
Fri.	20	6.40	9.50
Sat.	21	6.40	11.00
Sun.	22	6.50	12.00
Mon.	23	6.50	1.10 AM
Tue.	24	6 50	2.10
Wed.	25	6.50 LQ	3.20
Thu.	26	6.50	4.10
Fri.	27	6.50	4.50
Sat.	28	6.50	4.50
Sun.	29	6.50	4.40
Mon.	30	6.50	4.40
Tue.	31	6.50 NM	4.40

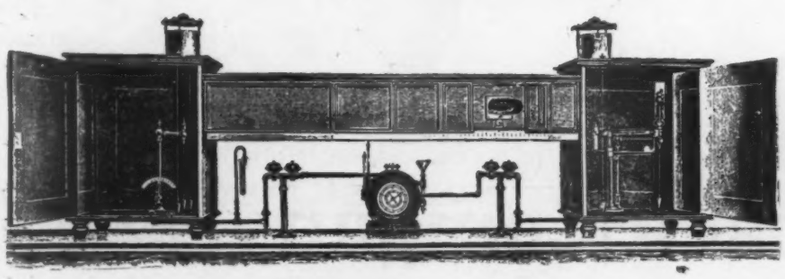
TOTAL HOURS DURING 1908.

By Table No. 1.

	Hrs. Min.
January	228.30
February	187.30
March	192.00
April	160.10
May	155.10
June	138.00
July	155.50
August	173.40
September	185.20
October	214.00
November	218.10
December	226.40
Total, yr.	2235.00







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PUBLIC LIGHTING TABLE.

MARCH, 1908.

Table No. 2.
NEW YORK CITY.
ALL NIGHT LIGHTING.

Day of Week.	Date.	Complete Lighting in One Hour From Time Given P. M.	Complete Extinguishing in 50 Minutes From Time Given A. M.
Sun.	1	5.22	5.32
Mon.	2	5.22	5.27
Tue.	3	5.22	5.27
Wed.	4	5.22	5.27
Thu.	5	5.32	5.17
Fri.	6	5.32	5.17
Sat.	7	5.32	5.17
Sun.	8	5.32	5.17
Mon.	9	5.32	5.17
Tue.	10	5.32	5.17
Wed.	11	5.32	5.17
Thu.	12	5.42	5.07
Fri.	13	5.42	5.07
Sat.	14	5.42	5.07
Sun.	15	5.42	5.07
Mon.	16	5.42	5.07
Tue.	17	5.42	5.07
Wed.	18	5.42	5.07
Thu.	19	5.52	4.57
Fri.	20	5 52	4.57
Sat.	21	5 52	4.57
Sun.	22	5.52	4.57
Mon.	23	5.52	4.57
Tue.	24	5.52	4.57
Wed.	25	5.52	4.57
Thu.	26	5.57	4 47
Fri.	27	5.57	4.47
Sat.	28	5.57	4.47
Sun.	29	5.57	4.47
Mon.	30	5.57	4.47
Tue.	31	5.57	4.47

TOTAL HOURS DURING 1908.

	Hrs. Min.
January	481:50
February	329.15
March	351.50
April	341.50
May	233.05
June	218.10
July	282.55
August	254.55
September	292.25
October	420.45
November	374.30
December	411.05
	3992.35
Deduct on account of 50 min. extinguish'ng time	30.30
Total, yr.	3962.05

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Holyoke, Mass.
Peoria, Ills.
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Galveston, Tex. (2d contract).
Quebec, Canada.
Indianapolis, Ind. (2d contract).
Bessemer, Ala.
Waterbury, Conn. (5th contract).
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Poughkeepsie, N.Y. (2d contract).
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Norfold, Va. (4th contract).
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Richmond, Va. (2d contract).
Oak Bluffs, Mass.
Arlington, Mass.

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TOTAL SETS INSTALLED TO DECEMBER 31, 1907, ... 677
TOTAL DAILY CAPACITY, TO DECEMBER 31, 1907, ... 545,865,000 cu. ft.

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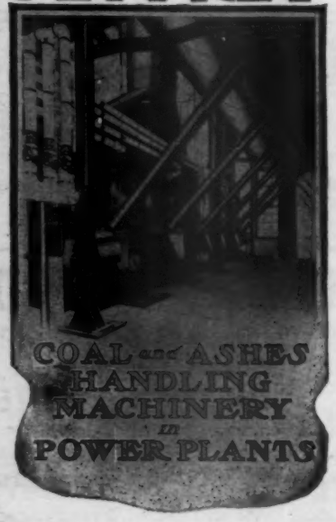

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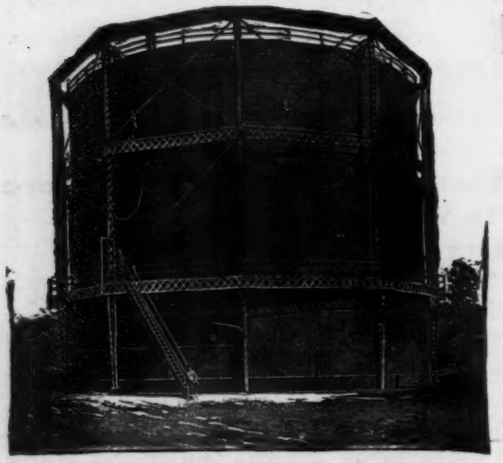

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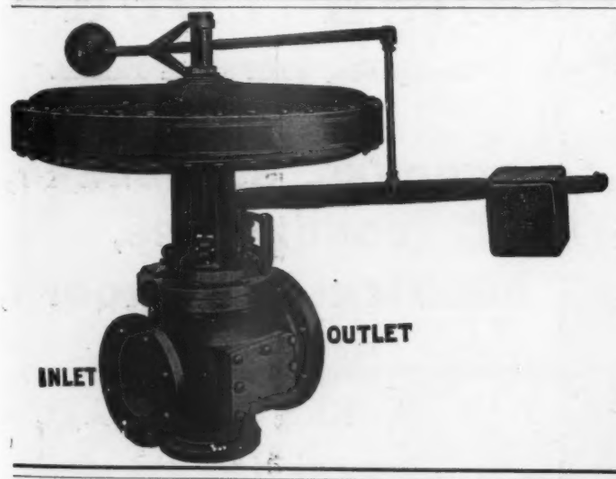

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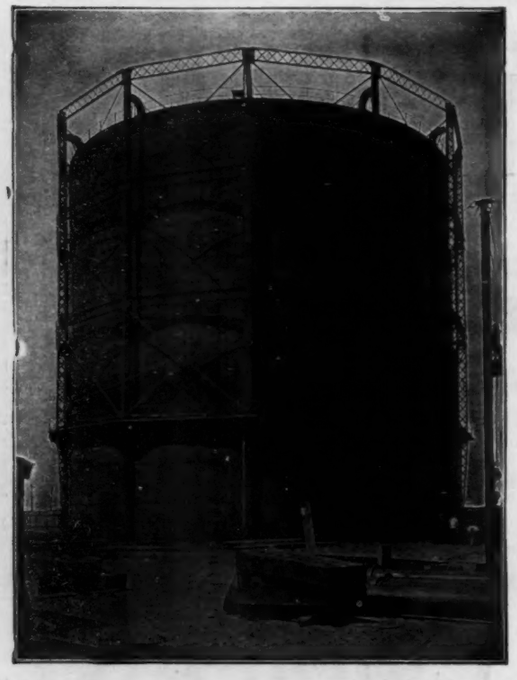

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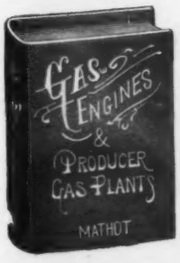

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